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The major purpose of this guide is to elicit the information necessary for writing educational specifications for facilities to house technical education programs in metallurgy. It is organized in these parts: (1) Part I discusses the major purpose, underlying assumptions, recent instructional trends, and guiding principles utilized in the preparation of the guide, (2) Part II provides data collection instruments for basic program features, educational objectives, and the training program, (3) Part III provides data collection instruments for quantative and qualitative facility needs, and (4) Part IV includes an annotated bibliography of 21 items published between 1959 and 1968. A total of 17 data collection instruments and instructions for their use are included. (EM)

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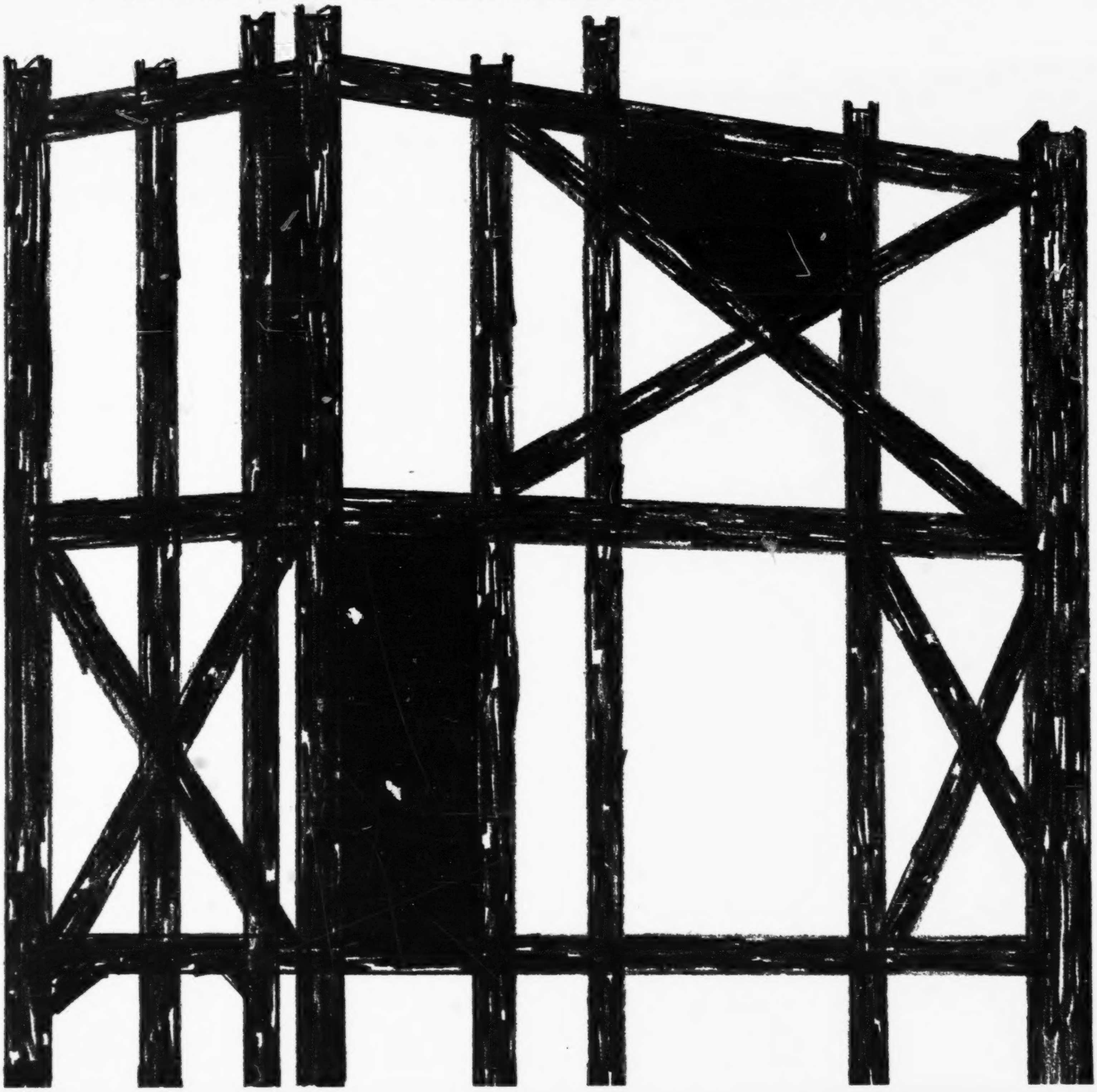
THE CENTER FOR VOCATIONAL
AND TECHNICAL EDUCATION

THE OHIO STATE UNIVERSITY
1900 Kenny Rd., Columbus, Ohio, 43210

RESEARCH 28

A GUIDE FOR PLANNING FACILITIES FOR OCCUPATIONAL PREPARATION PROGRAMS in METALLURGY TECHNOLOGY



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1. To provide continuing reappraisal of the role and function of vocational and technical education in our democratic society;
2. To stimulate and strengthen state, regional, and national programs of applied research and development directed toward the solution of pressing problems in vocational and technical education;
3. To encourage the development of research to improve vocational and technical education in institutions of higher education and other appropriate settings;
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RESEARCH 28

INTERIM REPORT
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A GUIDE FOR PLANNING FACILITIES FOR OCCUPATIONAL PREPARATION PROGRAMS IN METALLURGY TECHNOLOGY

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FOREWORD

One of the most fundamental concerns in planning for vocational and technical education facilities is that of assuring that educational requirements dictate the nature of the facilities. Other concerns include planning a sufficiently adaptable and flexible structure to permit needed modifications and programmatic changes over the lifetime of the building. Experiences have shown that adequate manuals and guide materials can provide substantial assistance in planning educational facilities. This document is a guide for planning facilities for occupational preparation programs in metallurgy technology. The information recorded in the guide is to be used in the preparation of educational specifications.

The guide lists a series of pivotal questions about the educational program to be offered. The answers to these program questions bear directly on the numbers and kinds of instructional areas needed in the contemplated facilities. After program decisions are recorded, the guide provides for the description of instructional areas needed to meet program requirements. Much of the material is presented in a checklist format which allows for consideration of alternatives in facility planning.

The guide was designed for use by any person or groups of persons responsible for planning metallurgy technology training facilities. It is anticipated that knowledgeable persons such as metallurgy technology instructors, state supervisors, university school plant planners, and local administrators will find the guide a useful planning tool. The guide can also be used for instructional purposes at universities, colleges, seminars, and institutes.

This guide is the sixth in a series being developed by The Center. Subsequent guides will be published for automotive services, dental technology, electrical technology, and medical technology. The first five guides developed were in the fields of home economics, machine trades, data processing, business and office occupations, and animal science technology. All guides follow the general format developed by The Center project staff and M. J. Conrad, head, Administration and Facilities Unit, College of Education, The Ohio State University. Vocational educators should also refer to the basic guide, A Guide to Systematic Planning for Vocational and Technical Education Facilities.

The Center for Vocational and Technical Education, The Ohio State University, worked cooperatively with Carl German, Jr., department head, Norwalk Technical College, Norwalk, Connecticut, in preparing this planning guide. Center project staff members were Richard F. Meckley, Ivan E. Valentine, and Zane McCoy.

The Center is grateful to the many individuals and groups whose assistance and suggestions led to the successful conclusion of the project. Special appreciation is due Frank A. Gourley, educational consultant, Engineering Technologies, Department of Community Colleges, Raleigh, North Carolina and James G. C. Sweeney, Technical Institute of Alamance, Burlington, North Carolina, for their thoughtful and helpful review of the initial draft of the guide.

Robert E. Taylor, Director

The Center for Vocational
and Technical Education

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PART I

INTRODUCTION

PURPOSE OF GUIDE

The major purpose of this guide is to elicit the necessary information for the writing of educational specifications for facilities to house needed technician training programs in metallurgy.

In addition to the major purpose of providing important and comprehensive information to be incorporated in educational specifications, the guide is designed to:

- Assist planners in the formation of creative solutions to the housing of desired educational programs.
- Prevent important considerations from being overlooked in the facility planning process.
- Encourage logical and systematic facility planning.

ORGANIZATION OF GUIDE

The facility planning guide is organized under four major headings or parts. Part I (Introduction) is a discussion of the major purpose, the underlying assumptions, recent instructional trends, and the guiding principles which were utilized in the preparation of the guide.

In Part II (The Instructional Program) important information is sought on the metallurgy department's basic objectives, and the kinds of technician training programs which will be organized to implement them.

In Part III (Distinct Types of Instructional Areas to be Provided) the actual spaces desired to house the technician training programs are described in detail.

2/3

Part IV is an annotated bibliography of reference sources which offer a more detailed treatment of the various phases of facility planning.

UNDERLYING ASSUMPTIONS

Important assumptions were made in the preparation of this guide. They were:

- Major educational program decisions have or are being made. Content of instruction has been determined through educational surveys, advisory committees, school board study, etc. Instructional methods have been determined by qualified instructors and other appropriate staff members. To assure adequate educational program planning, the guide will ask important questions which may serve as guidelines to such planning.

- A cooperative and collaborative relationship has been established with knowledgeable local agencies who are aware of economic, political, and social conditions which must be taken into account in short- and long-range educational planning.

- Educational, economic, political, and social planning has revealed the approximate numbers and kinds of students (school-age and adult) to be served by the proposed school. Such information has been provided by enrollment projections, census tract data, student interest studies, etc.

- The information recorded in this document will be used in the preparation of educational specifications for use by an architect(s) in facility design.

- Sufficient funds are or can be made available to support both the provision of facilities and the operation of the desired occupational preparation programs.

RECENT INSTRUCTIONAL TRENDS

- Expanded programs to reach not only the average and those who are college bound, but also the unusually gifted, the physically handicapped, the mentally retarded, and the culturally disadvantaged are needed and being provided by occupational preparation programs.

- Cooperation among instructors in developing interdisciplinary units or courses is increasing. Cooperative instruction is encouraged and facilitated by the proximity of instructional and work areas where the teachers can plan together and produce instructional materials.

- Mobile equipment and convenient space for storing it is making the same space available for many purposes and resulting in more effective and efficient use of space.

- Mechanical and electronic teaching aids are being utilized to a greater degree by instructors in occupational preparation programs. To some extent, the effective use of such devices depends upon the accessibility and convenience of storage.

GUIDING PRINCIPLES

In planning facilities to house occupational preparation programs, it is suggested that educational program and facility decisions be consistent with the following guiding principles.

- The educational program is the basis for planning space and facilities.

- Space and facilities should be planned to accommodate changes in the educational program.

- The program should be planned to serve the needs of a variety of groups in the community.

- Space and facilities for the program can be extended through the use of community resources.

- Safe and healthful housing must be provided for all students.

- Space and facilities for occupational preparation programs should be considered in context with the total educational program of the institution and the community.

PART II

THE INSTRUCTIONAL PROGRAM

In Part II of the guide, important instructional program decisions with respect to basic program features, objectives, and needed information on technician training programs to be housed are recorded.

BASIC PROGRAM FEATURES

Basic features of the educational program are determined greatly by a school or department's educational philosophy. A philosophy of education provides a base from which program objectives and teaching and learning activities designed to meet these objectives can be derived. In the final analysis it is the kinds of teaching and learning activities to be carried on which should determine facility needs.

In this section, planners have an opportunity to express basic program features which will serve as guidelines for the planned technician preparation programs in metallurgy.

Indicate below the relative degree of emphasis to be placed on each of the program features stated by circling the appropriate number. The scale provided for this purpose ranges from 1 for major emphasis, 2 for some emphasis, 3 for slight emphasis, to N for no emphasis. This same scale will be used frequently throughout the planning guide.

1 major emphasis
2 some emphasis
3 slight emphasis
N no emphasis

1. Purpose of program

   a. The purpose of the program will be the preparation of students for gainful employment. 1 2 3 N

1 major emphasis
2 some emphasis
3 slight emphasis
N no emphasis

b. The purpose of the program will be the preparation of students for entry into further training programs. The nature of this further training is ______________
____
____
______________________________ 1 2 3 N

c. The purpose of the program will be the training of employed adults to advance in their fields. The nature of this further training is ______________
____
____
______________________________ 1 2 3 N

d. The purpose of the program will be the replacement of unemployable skills in appropriate evening or night school courses. The nature of this adult training is ______________
____
____
______________________________ 1 2 3 N

e. Other program purposes which should be included are:
   1) ______________________________
   2) ______________________________
   3) ______________________________
   4) ______________________________

2. Students

a. Student admission to the program is on the basis of selective criteria which include:
   1) ______________________________
   2) ______________________________
   3) ______________________________
   4) ______________________________

b. The program will place emphasis on skill acquisition. 1 2 3 N

c. The program will place emphasis on the learning of theory. 1 2 3 N

d. The students will have freedom of movement and access to learning materials. 1 2 3 N

e. Students will be encouraged to act independently. 1 2 3 N

f. Students will be provided with cooperative work experience outside the school. 1 2 3 N

g. Other basic program features relating to students which should be included are:
   1) ______________________________
   2) ______________________________

3) ______________________________
4) ______________________________

3. Instruction

   a. The instructional approach will be single discipline (metallurgy) as opposed to inter-disciplinary (metallurgy, science, etc.). If not a single discipline approach, describe the inter-disciplinary approach and the disciplines involved. ______
   ____
   ____
   ____
   ______________________________ Yes No

   b. Cooperative or team instruction will be used. If this mode of instruction is to be extensively emphasized, describe in general terms. ____________
   ____
   ____
   ______________________________ Yes No

   c. Community resources will be utilized in instruction. If a high emphasis is to be placed on use of community resources, describe some of these resources. ___
   ____
   ____
   ______________________________ Yes No

   d. Instructional flexibility is required. If a high emphasis is to be placed on instructional flexibility, describe the kinds of flexibility desired. ______
   ____
   ____
   ______________________________ Yes No

4. Highly specialized technical courses on new processes and/or equipment (e.g., instrumentation) will be made available based on demand. Practicing experts in the field will be used as instructors (see page 6, Basic Program Features--1. c.). Yes No

5. Other basic program features important to the planned instructional program:

   a. ______________________________
   ____
   b. ______________________________
   ____
   c. ______________________________
   ____
   d. ______________________________
   ____

EDUCATIONAL OBJECTIVES

Educational objectives are often identified as goals or outcomes of the educational program. An objective should describe a desired educational outcome that is consistent with a school's philosophy.

Objectives are important to both the planner and the architect since they determine the school's program and related activities. They provide important implications which when translated into facilities can both enhance as well as adequately house the desired program. Thus it becomes imperative to clearly establish the program objectives prior to embarking on educational specifications and subsequent building design.

The purpose of this part of the guide is to bring together these elements in a way to provide direction and understanding for both planner and architect. Space is provided below to indicate degree of emphasis by circling the appropriate number for each of the objectives, and to list additional objectives. The scale provided for this stated purpose ranges from 1 for major emphasis down to N for no emphasis.

1 major emphasis
2 some emphasis
3 slight emphasis
N no emphasis

1.	To prepare students for entry into gainful employment	1	2	3	N
2.	To motivate and recruit capable and qualified students to enroll in post-high school	1	2	3	N
3.	To permit students to retrain or return to continue training	1	2	3	N
4.	To provide pre-professional educational training for students who plan to enter colleges and universities	1	2	3	N
5.	To develop in students specific and measurable knowledge and skills in manufacturing metallurgy which include:				
a.	The ability to apply the principles of physical metallurgy	1	2	3	N
b.	Broad knowledge of manufacturing processes and materials fabrication	1	2	3	N
c.	The ability to apply statistical quality control procedures	1	2	3	N
d.	The ability to specify and/or monitor routine metallurgical control test procedures	1	2	3	N
e.	The ability to provide and monitor simulated field service tests on manufactured products	1	2	3	N

1 major emphasis
2 some emphasis
3 slight emphasis
N no emphasis

f. The ability to analyze service failures and customer complaints 1 2 3 N
g. ______________________________ 1 2 3 N
h. ______________________________ 1 2 3 N

6. To develop in students specific and measurable knowledge and skills in foundry metallurgy which include:

a. The ability to apply the principles of physical metallurgy 1 2 3 N
b. Broad knowledge of the commercial casting processes 1 2 3 N
c. Familiarity with the design requirements for castings, patterns, and mold materials 1 2 3 N
d. The ability to specify and/or monitor control tests on molding materials 1 2 3 N
e. The ability to specify and/or monitor control tests on metal melting and thermal treatments of castings 1 2 3 N
f. The ability to specify and/or monitor inspection and control test procedures on the casting and finishing operations 1 2 3 N
g. ______________________________ 1 2 3 N
h. ______________________________ 1 2 3 N

7. To develop in students specific and measurable knowledge and skills in metallography which include:

a. The ability to apply the principles of physical metallurgy 1 2 3 N
b. Proficiency in sampling and specimen preparation techniques 1 2 3 N
c. Proficiency in the field of photography 1 2 3 N
d. The ability to prepare, interpret and report on photomacrographs and photomicrographs of specimens 1 2 3 N
e. The ability to analyze service failures and investigate customer complaints 1 2 3 N
f. ______________________________ 1 2 3 N
g. ______________________________ 1 2 3 N

8. To develop in students specific and measurable knowledge and skills in powder metallurgy which include:

a. The ability to apply the principles of physical metallurgy 1 2 3 N
b. The ability to apply statistical quality control procedures 1 2 3 N

1 major emphasis
2 some emphasis
3 slight emphasis
N no emphasis

c. Knowledge of metal powder production methods, powder handling and storage techniques, and powder mixing methods 1 2 3 N
d. The ability to specify and/or monitor tests to control powder mixing, sintering parameters, furnace atmospheres, and finished parts quality 1 2 3 N
e. Knowledge of parts and tooling design as they affect briquetting practices 1 2 3 N
f. ______________________________ 1 2 3 N
g. ______________________________ 1 2 3 N

9. To develop in students specific and measurable knowledge and skills in extractive metallurgy which include:

a. The ability to apply the principles of ore refining (mineral extraction) 1 2 3 N
b. Proficiency in sizing and sampling techniques 1 2 3 N
c. Knowledge of the equipment and control procedures for roasting, leaching, and flotation of ore samples 1 2 3 N
d. The ability to specify and/or monitor and report on control tests in the refining process 1 2 3 N
e. ______________________________ 1 2 3 N
f. ______________________________ 1 2 3 N

10. To develop in students specific and measurable skills and knowledge in physical metallurgy, research and development which include:

a. The ability to apply the principles of physical metallurgy 1 2 3 N
b. The ability to participate in research on new alloying methods on new alloys for specific properties or service requirements 1 2 3 N
c. The ability to participate in research on control and testing procedures for quality assurance of new alloys 1 2 3 N
d. The ability to participate in research on thermal treatments, surface treatments, and joining techniques 1 2 3 N
e. The ability to participate in research on single crystal techniques, fiber reinforced alloys, and ultra-purity metal refining. 1 2 3 N
f. The ability to participate in research on micro-integrated circuitry techniques 1 2 3 N
g. ______________________________ 1 2 3 N
h. ______________________________ 1 2 3 N

11. Other program objectives include:

a. ______________________________
b. ______________________________
c. ______________________________
d. ______________________________

PROGRAM CONTENT AREAS

The educational program for training technicians in metallurgy should be designed to meet its established objectives. All decisions made with respect to the educational program should be consistent with established philosophy and objectives. The training of a metallurgical technician to meet the above objectives will require an educational program of intensive study of the basic sciences and mathematics plus an intensive laboratory-oriented curriculum of technical specialties.

The courses will provide the ability to apply scientific principles to the processes, procedures, techniques, materials, and modern instrumentation of industry. The course content will enable the technician to communicate with the metallurgical engineer or scientist doing research, development, or production work and function as an assistant.

Instruction in technician training is usually given in discrete subject areas or courses. Subject matter is coordinated with appropriate field, laboratory, and work experience. Programs for technician training in metallurgy may be classified under six broad headings or content areas of 1) supporting services; 2) manufacturing processes; 3) materials testing; 4) heat-treating; 5) metallography; and 6) instrumentation.

These six content areas relate directly to the field of metallurgy and can be used to categorize most technician training programs in the field. However, students in these programs elect or are required to take courses in subjects such as English, mathematics, and physical education which are available to all students. For example, a student training to become a manufacturing metallurgy technician may pursue the following curriculum during one semester:

Courses	Content Areas
Mathematics I	Academic
Physics I	Science
Chemistry I	Science
Technical Report Writing	Academic
Metal Fabrication	Manufacturing Processes

The concept of content areas is used in this planning guide because different instructional content areas usually call for different instructional facilities and equipment. The following content areas which usually call for specialized instructional areas are used in this guide.

- *Supporting Services*
  Academic--English, math, social studies
  Science--physics, chemistry, general electricity
  Physical Education
  Other--this category is used in the event that a course or unit to be offered will not fit into any of the above content areas

- *Manufacturing Processes*--foundry, machine shop, presses, rolling equipment

- *Materials Testing*--hardness testers, tensile testers, torsion testers, environmental testers, etc.

- *Heat-treating*--ovens, atmosphere generators, vacuum equipment, quenching facilities, etc.

- *Metallography*--cut-off wheels, mounting press, grinding and polishing wheels, microscopes, metallograph

- *Instrumentation*--emission spectrograph, x-ray diffraction, gas analyzers, x-radiography, ultra-sonic testers, magnetic testing,etc.

PLANNING INSTRUCTIONAL AREAS BY MODES OF LEARNING

The planning of instructional areas for occupational preparation facilities can be substantially aided through utilization of the concept of modes of learning. Learning can be divided into three distinct modes--reaction learning, interaction learning, and action learning.

Reaction learning, which usually occurs in an instructional area designed for lecture and demonstration, is characterized by activities which tend to be largely teacher-centered with the central focus on instruction. Student activities include listening, observing, and the taking of notes. Group size may vary from one to a very large number as the number of students has little effect on the learning experience if proper technological aids such as television, microphones, projectors and the like are used. Because student activities are relatively passive in reaction learning, a short optimal time span is normally employed.

Lecture/demonstration areas can be used commonly for reaction learning in all subject areas. For example, in planning facilities for two diverse occupational preparation programs in foundry metallurgy and metallography, the planner should bear in mind that reaction learning for students in both programs can occur in the same kind of instructional area. This means that facility planning should be done in terms of the total program rather than its fractional parts. In many instances, lecture/demonstration areas can be shared not only by occupational preparation programs within vocational service areas, but also shared by distinct and dissimilar service areas such as technician programs and business occupations. Where a great deal of facility sharing is planned the planner should consider the relative merits of optimal location within the total building and the advisability of clustering various instructional areas.

Interaction learning, which usually occurs in a seminar instructional area, is characterized by both teacher and learner activity participating as both listener and speaker. This mode of learning, of course, must occur in groups; however, sociological research suggests these groups should not exceed 15 persons for optimal effectiveness. Active interaction of all students generally requires a longer time span than reaction learning.

Seminar areas, like lecture/demonstration areas, are usually designed for common use by all vocational service areas. The same considerations which were outlined for lecture/demonstration areas also apply to seminar areas.

Action learning, which usually occurs in a laboratory-type instructional area, allows students to learn by doing. Students learn on an individual basis, but may, nevertheless, function in a group setting. Often in more flexible types of educational programs, students are scheduled for laboratory work on an individual basis. Since action learning involves overt action by individual students, the teacher's role is largely that of a consultant to the learner.

Laboratory areas, of necessity, are more specialized than lecture/demonstration areas used for reaction learning and seminar areas used for interaction learning. Since laboratory areas are designed to facilitate the learning of specific skills, there is less likelihood of sharing such areas by students in various training programs. However, wherever common elements of skill instruction are found among occupational preparation programs, the sharing and clustering laboratory facilities can be both expedient and economical.

SPECIALIZED AND MULTI-USE OF INSTRUCTIONAL AREAS

The relative amounts of time to be spent by students in a given occupational preparation program in reaction, interaction, and action learning has definite implications for the number and kind of spaces to be provided. These time considerations combined with decisions on the degree of specialization versus multi-use help determine the nature of facilities required. Since most occupational programs have concentrated on action learning experiences, facilities designed for a particular program have seldom provided adequate reaction and interaction facilities because of the limited utilization of such spaces. However, if the learning activities in any preparation program are broken down into the modes of learning, it will be noted that reaction and interaction spaces are the same regardless of the vocational area. Therefore, by providing common reaction and interaction spaces for all programs, the most modern technological aids can be justified which, in most cases, will permit lectures, demonstrations and other group reaction learning experiences for groups larger than typically used in vocational education programs. Not only will group reaction learning be improved but more time will become available for the professional staff to work with individuals and small groups in interaction and action learning activities.

Scheduling group reaction and interaction learning experiences into specialized facilities permits complete flexibility in the use of action learning laboratories on an open individualized basis since students would no longer need to be scheduled into the action learning laboratories on a specific class basis. This will permit 100 percent room utilization of laboratories and also permit the introduction of differentiated staff assignments into vocational education.

The open laboratory concept also permits the planned sharing of certain specialized equipment which may be required by two or more occupational preparation programs.

NOTE: THE FOLLOWING SECTIONS OF THE GUIDE (PAGES 18-37) WILL ASSIST THE PLANNER IN MAKING MATHEMATICAL DETERMINATIONS OF THE NUMBERS OF INSTRUCTIONAL AREAS NEEDED TO HOUSE THE DESIRED PROGRAM. IF THE NUMBERS OF INSTRUCTIONAL AREAS REQUIRED ARE ALREADY KNOWN, THE PLANNER MAY NOW PROCEED TO FORM E, PAGE 39. IF, HOWEVER, MATHEMATICAL DETERMINATIONS ARE TO BE MADE, ALL FORMS SHOULD BE COMPLETED AS ACCURATELY AS POSSIBLE.

OCCUPATIONAL PREPARATION PROGRAMS TO BE OFFERED

Information on each technician training program to be offered is entered on a separate Form A which follows. Directions for completing Form A(s) appear on pages 21-24. To assist planners, a sample, completed Form A is given on page 20. Data entered in the sample Form A are for a foundry metallurgy program. The data were assumed for purpose of illustration. Form A for each occupational preparation program should be filled out as completely as possible. However, it is realized, for example, that a metallurgy instructor completing Form A may be unaware of time allotments and methods of instruction in other subject areas. If such is the case, the instructor can only supply information on courses within the content areas of metallurgy.

INSTRUCTIONS FOR COMPLETING FORM A
BASIC PROGRAM INFORMATION

Item 1

Occupational Preparation Program--Enter here the name of the occupational program to be offered, e.g., foundry metallurgical technician.

Item 2

Yearly Enrollment--Enter here the projected maximum number of students to be enrolled yearly in the program.

Item 3

Nature of Students--Underline all categories which apply to the students to be enrolled in the program.

Item 4

Weeks of Instruction per Year--Enter here the number of weeks per year the school will be open for instruction, e.g., 36 weeks, 52 weeks.

Item 5

Total Weekly Periods or Modules--Enter here the total number of periods or modules (if modular scheduling is to be used) per week available for instructional purposes for each student. Do not count periods or modules scheduled for lunch and other non-instructional purposes.

Column 6

Courses of Instruction--List the courses or units of instruction to be offered either on a required or elective basis for the occupational preparation program.

Column 7

Content Area--Opposite each course of instruction, enter the appropriate content area as presented on page 13.

Column 8

Total Course Enrollment--Opposite each course of instruction, enter the projected maximum student enrollment.

Column 9

Maximum Group Size for Reaction Learning--Opposite each course or unit of instruction, enter the maximum group size in number of students for reaction (lecture/demonstration) type learning.

Column 10

Estimated Weekly Periods or Modules of Reaction Level Learning--Opposite each course or unit of instruction, enter the estimated number of periods or modules per week to be devoted to reaction learning per student.

Column 11

Weekly Group-Periods or Modules (Lecture/Demonstration)--To compute weekly group-periods or modules, divide the entry in Column 8 by the entry in Column 9 and round up to the nearest whole number. Then multiply the whole number by the entry in Column 10.

Column 12

Maximum Group Size for Interaction Learning--Opposite each course or unit of instruction, enter the maximum group size in number of students for interaction (seminar) type learning.

Column 13

Estimated Weekly Periods or Modules of Interaction Level Learning--Opposite each course or unit of instruction, enter the estimated number of periods or modules per week to be devoted to interaction learning per student.

Column 14

Weekly Group-Periods or Modules (Seminar)--To compute weekly group-periods or modules, divide the entry in Column 8 by the entry in Column 12 and round up to the nearest whole number. Then multiply the whole number by the entry in Column 13.

Column 15

Maximum Group Size for Action Learning--Opposite each course or unit of instruction, enter the maximum group size in number of students for action (laboratory) type learning.

Column 16

Estimated Weekly Periods or Modules of Action Level Learning--Opposite each course or unit of instruction, enter the estimated number of periods or modules per week to be devoted to action learning per student.

Column 17

Weekly Group-Periods or Modules (Laboratory)--To compute weekly group-periods or modules, divide the entry in Column 8 by the entry in Column 15 and round up to the nearest whole number. Then multiply the whole number by the entry in Column 16.

SAMPLE FORM A

BASIC PROGRAM INFORMATION

1. Technician Training Program for: *Foundry Metallurgist*
2. Yearly Enrollment *120*
3. Nature of Students (underline appropriate categories): a. day school[1]; b. night school[1]; c. school age; d. adults; e. males; f. females; other (specify) ____________
4. Weeks of Instruction per Year *36*
5. Total Weekly Periods or Modules *30*

Courses of Instruction (6)	Content Areas (7)	Total Course Enrollment (8)	Maximum Group Sizes, Estimated Weekly Periods or Modules and Calculated Group-Modules or Group-Periods by Levels of Learning								
			REACTION*			INTERACTION**			ACTION***		
			Maximum Group Size (9)	Weekly Periods or Modules (10)	Weekly Group-Periods or Modules (11)	Maximum Group Size (12)	Weekly Periods or Modules (13)	Weekly Group-Periods or Modules (14)	Maximum Group Size (15)	Weekly Periods or Modules (16)	Weekly Group-Periods or Modules (17)
Foundry I	*Man.Proc.*	*60*	*100*	*1*	*1*	*15*	*2*	*8*	*25*	*7*	*21*
Foundry II	*Man.Proc.*	*60*	*100*	*1*	*1*	*15*	*3*	*12*	*25*	*6*	*18*
Math I	*Academic*	*60*	*100*	*3*	*3*	*15*	*1*	*4*	*25*	*1*	*3*
Math II	*Academic*	*60*	*100*	*2*	*2*	*15*	*2*	*8*	*25*	*1*	*3*
English I	*Academic*	*60*	*50*	*2*	*4*	*15*	*3*	*12*	*0*	*0*	*0*
Tech.Writing	*Academic*	*60*	*50*	*1*	*2*	*15*	*4*	*16*	*0*	*0*	*0*
Physics	*Science*	*20*	*50*	*1*	*1*	*0*	*0*	*0*	*25*	*4*	*4*
Chemistry	*Science*	*10*	*50*	*2*	*1*	*0*	*0*	*0*	*25*	*5*	*5*
Phys. Ed. I	*Phys.Ed.*	*35*	*25*	*1*	*2*	*15*	*1*	*3*	*20*	*3*	*6*
Phys. Ed. II	*Phys.Ed.*	*30*	*25*	*1*	*2*	*15*	*1*	*2*	*20*	*3*	*6*

[1] If both day and night school are to be offered, fill out separate forms for each.

*(Lecture/demonstration)

**(Seminar)

***(Laboratory)

FORM A

BASIC PROGRAM INFORMATION

1. Technician Training Program for: ____________________
2. Yearly Enrollment __________
3. Nature of Students (underline appropriate categories): a. day school[1]; b. night school[1]; c. school age; d. adults; e. males; f. females; other (specify) ______________
4. Weeks of Instruction per Year __________
5. Total Weekly Periods or Modules __________

Courses of Instruction	Content Areas	Total Course Enrollment	Maximum Group Sizes, Estimated Weekly Periods or Modules and Calculated Group-Modules or Group-Periods by Levels of Learning								
			REACTION*			INTERACTION**			ACTION***		
(6)	(7)	(8)	Maximum Group Size (9)	Weekly Periods or Modules (10)	Weekly Group-Periods or Modules (11)	Maximum Group Size (12)	Weekly Periods or Modules (13)	Weekly Group-Periods or Modules (14)	Maximum Group Size (15)	Weekly Periods or Modules (16)	Weekly Group-Periods or Modules (17)

---

[1] If both day and night school are to be offered, fill out separate forms for each.

*(Lecture/demonstration)

**(Seminar)

***(Laboratory)

FORM A

BASIC PROGRAM INFORMATION

1. Technician Training Program for: ______________________________
2. Yearly Enrollment ____________
3. Nature of Students (underline appropriate categories): a. day school[1]; b. night school[1]; c. school age; d. adults; e. males; f. females; other (specify) ____________________
4. Weeks of Instruction per Year __________
5. Total Weekly Periods or Modules __________

Courses of Instruction (6)	Content Areas (7)	Total Course Enrollment (8)	Maximum Group Sizes, Estimated Weekly Periods or Modules and Calculated Group-Modules or Group-Periods by Levels of Learning								
			REACTION*			INTERACTION**			ACTION***		
			Maximum Group Size . (9)	Weekly Periods or Modules (10)	Weekly Group-Periods or Modules (11)	Maximum Group Size (12)	Weekly Periods or Modules (13)	Weekly Group-Periods or Modules (14)	Maximum Group Size (15)	Weekly Periods or Modules (16)	Weekly Group-Periods or Modules (17)

FORM A

[1] If both day and night school are to be offered, fill out separate forms for each.

*(Lecture/demonstration)

**(Seminar)

***(Laboratory)

FORM A

BASIC PROGRAM INFORMATION

1. Technician Training Program for: ______________________________
2. Yearly Enrollment _____________
3. Nature of Students (underline appropriate categories): a. day school[1]; b. night school[1]; c. school age; d. adults; e. males; f. females; other (specify) ____________________
4. Weeks of Instruction per Year ___________
5. Total Weekly Periods or Modules ___________

Courses of Instruction (6)	Content Areas (7)	Total Course Enrollment (8)	Maximum Group Sizes, Estimated Weekly Periods or Modules and Calculated Group-Modules or Group-Periods by Levels of Learning								
			REACTION*			INTERACTION**			ACTION***		
			Maximum Group Size (9)	Weekly Periods or Modules (10)	Weekly Group-Periods or Modules (11)	Maximum Group Size (12)	Weekly Periods or Modules (13)	Weekly Group-Periods or Modules (14)	Maximum Group Size (15)	Weekly Periods or Modules (16)	Weekly Group-Periods or Modules (17)

---

[1] If both day and night school are to be offered, fill out separate forms for each.
*(Lecture/demonstration)
**(Seminar)
***(Laboratory)

FORM A

BASIC PROGRAM INFORMATION

1. Technician Training Program for: ____________________
2. Yearly Enrollment __________
3. Nature of Students (underline appropriate categories): a. day school[1]; b. night school[1]; c. school age; d. adults; e. males; f. females; other (specify) ______________
4. Weeks of Instruction per Year __________
5. Total Weekly Periods or Modules __________

Courses of Instruction (6)	Content Areas (7)	Total Course Enrollment (8)	Maximum Group Sizes, Estimated Weekly Periods or Modules and Calculated Group-Modules or Group-Periods by Levels of Learning								
			REACTION*			INTERACTION**			ACTION***		
			Maximum Group Size (9)	Weekly Periods or Modules (10)	Weekly Group-Periods or Modules (11)	Maximum Group Size (12)	Weekly Periods or Modules (13)	Weekly Group-Periods or Modules (14)	Maximum Group Size (15)	Weekly Periods or Modules (16)	Weekly Group-Periods or Modules (17)

[1] If both day and night school are to be offered, fill out separate forms for each.

*(Lecture/demonstration)

**(Seminar)

***(Laboratory)

FORM A

PART III

DISTINCT TYPE OF INSTRUCTIONAL AREAS TO BE PROVIDED

QUANTITATIVE FACILITY NEEDS

The number of instructional areas to house the programs described in Part II (The Instructional Program) are recorded in this section of the guide.

As indicated in Part II, there are three principal types of instructional areas used to accommodate educational programs. They are:

Lecture/demonstration areas--used principally for group reaction learning;

Seminar areas--used principally for group interaction learning; and

Laboratory areas--used principally for group or individual action learning.

In addition to these instructional areas, there are, of course, other school-wide auxiliary areas such as instructional materials centers, language laboratories, gymnasiums, and auditoriums which are part of the overall school plan. Requirements for such facilities are calculated as a part of total school planning and are not made in this guide.

It is recommended that facility needs, including technician training programs in metallurgy be made on a school-wide basis in order to provide planners with a balanced picture of the building to be constructed and in order to provide economy and convenience through the sharing and clustering of various kinds of facilities and equipment.

Forms B, C, and D can be used to compute the number of lecture/demonstration, seminar, and laboratory areas required, respectively, for the planned programs in technician training in metallurgy. The use of these forms requires some mathematical ability. Personnel responsible for completing the guide may want to utilize the services of individuals with this special competence.

Results of the computations on Forms B, C, and D are entered on Form E which is a summary of total instructional area requirements for metallurgy technology preparation programs.

In the event that instructional area requirements are already determined (e.g., it has been decided that one combination laboratory and lecture/demonstration area will be provided) the information can be recorded directly on Form E without making the computations on Forms B, C, and D.

It is strongly recommended that appropriate personnel be utilized to ensure that the number of instructional areas is sufficient to meet program requirements. After the number of each type of instructional area is determined and recorded on Form E, information can then be recorded in the next section of the guide concerning the nature of these instructional areas.

INSTRUCTIONS FOR COMPLETING FORM B
LECTURE/DEMONSTRATION AREA REQUIREMENTS BY CONTENT AREAS

Column 1

Content Area--Content areas are listed in Column 1.

Column 2

Total Enrollment--To obtain total enrollment for content areas, find the total enrollment for each content area as indicated in Columns 7 and 8 of all Form A(s) for all occupational preparation programs.

Column 3

Maximum Group Size--Opposite each content area, enter the maximum group size desired for a lecture/demonstration area to serve the content area (Form A, Column 9).

Column 4

Total Weekly Periods or Modules--Opposite each content area, enter the total periods or modules per week the school will be open for day school instruction. This entry will be identical for all content areas and identical to the number recorded for Item 5, Form A.

Column 5

Total Weekly Reaction Group Periods or Modules--Opposite each content area, enter the total group periods or modules per week to be devoted to reaction learning as indicated in Column 11 of Form A(s) for all occupational preparation programs.

Column 6

Lecture/Demonstration Areas Required--Opposite each content area, enter the quotient of Item 5 divided by Item 4. Round up to the nearest hundredth.

Column 7

Adjusted Lecture/Demonstration Areas Required--To adjust for scheduling difficulties which result in areas being less than 100 percent utilized, multiply the entry in Column 6 by 1.3 and enter the result, rounded up to the nearest hundredth, in Column 7 for each content area.

Column 8

Totals--Since lecture/demonstration areas, unlike laboratory areas, can be utilized by nearly all content areas, the entries in Column 7 can be added for all lecture/demonstration areas with identical maximum group sizes as entered in Column 3. For example, 8a might read *2* lecture/demonstration areas with a student capacity of *50* each.

SAMPLE FORM B

LECTURE/DEMONSTRATION AREA REQUIREMENTS BY CONTENT AREAS

Content Area (1)	Total Enrollment (2)	Maximum Group Size (3)	Total Weekly Periods or Modules (4)	Total Weekly Reaction Group-Periods or Modules (5)	Lecture/Demonstration Areas Required (5) ÷ (4) (6)	Adjusted Lecture/Demonstration Areas Required (6) X 1.3 (7)
II Manufacturing Processes	120	100	30	2	0.07	0.09
III Materials Testing						
IV Heat Treating						
V Metallography						
VI Instrumentation						
I Supporting Services						
Academic	240	50	30	11	0.37	0.48
Science	30	50	30	2	0.07	0.09
Music						
Physical Education	65	25	30	4	0.13	0.17
Other (specify)						

(8) Totals (Figures in Column 7 can be added together for areas with same student capacity as entered in Column 3.) Round off total to next higher whole number.

a. 1 lecture/demonstration areas with a student capacity of 100, each.
b. 1 lecture/demonstration areas with a student capacity of 50, each.
c. 1 lecture/demonstration areas with a student capacity of 25, each.
d. ________ lecture/demonstration areas with a student capacity of ________, each.

Note: The entries in Column 7 indicate clearly that the lecture/demonstration areas would only be used sparingly by students enrolled in each of the content areas. One possibility might be construction of a lecture/demonstration area with a student capacity of 100 which could be subdivided to meet program requirements of all content areas. Another possibility would be the sharing of lecture/demonstration with other students enrolled in various other programs.

FORM B

LECTURE/DEMONSTRATION AREA REQUIREMENTS BY CONTENT AREAS

Content Area (1)	Total Enrollment (2)	Maximum Group Size (3)	Total Weekly Periods or Modules (4)	Total Weekly Reaction Group-Periods or Modules (5)	Lecture/Demonstration Areas Required (5) ÷ (4) (6)	Adjusted Lecture/Demonstration Areas Required (6) X 1.3 (7)
II Manufacturing Processes						
III Materials Testing						
IV Heat Treating						
V Metallography						
VI Instrumentation						
I Supporting Services						
Academic						
Science						
Music						
Physical Education						
Other (specify)						

(8) Totals (Figures in Column 7 can be added together for areas with same student capacity as entered in Column 3.) Round off total to next higher whole number.

a. __________lecture/demonstration areas with a student capacity of ________, each.
b. __________lecture/demonstration areas with a student capacity of ________, each.
c. __________lecture/demonstration areas with a student capacity of ________, each.
d. __________lecture/demonstration areas with a student capacity of ________, each.

INSTRUCTIONS FOR COMPLETING FORM C
SEMINAR AREA REQUIREMENTS BY CONTENT AREAS

Column 1

Content Area--Content areas are listed in Column 1.

Column 2

Total Enrollment--To obtain total enrollment for content areas, find the total enrollment for each content area indicated in Columns 7 and 8 of Form A for all occupational preparation programs.

Column 3

Maximum Group Size--Opposite each content area, enter the maximum group size desired for a seminar area to serve the content area (Form A, Column 12).

Column 4

Total Weekly Periods or Modules--Opposite each content area, enter the total periods or modules per week the school will be open for day school instruction. This entry will be identical for all content areas and identical to the number recorded for Item 5, Form A.

Column 5

Total Weekly Interaction Group Periods or Modules--Opposite each content area, enter the total group periods or modules per week to be devoted to interaction learning as indicated in Column 14 of Form A(s) for all occupational preparation programs.

Column 6

Seminar Areas Required--Opposite each content area, enter the quotient of Item 5 divided by Item 4. Round up to the nearest hundredth.

Column 7

Adjusted Seminar Areas Required--To adjust for scheduling difficulties which result in areas being less than 100 percent utilized, multiply the entry in Column 6 by 1.3 and enter the result, rounded up to the nearest hundredth, in Column 7 for each content area.

Column 8

Totals--Since seminar areas, unlike laboratory areas, can be commonly utilized by nearly all content areas, the entries in Column 8 can be added for all seminar areas with identical maximum group sizes or entered in Column 3. For example, 8a might read *2* seminar areas with a student capacity of *20*, each.

SAMPLE FORM C

SEMINAR AREA REQUIREMENTS BY CONTENT AREAS

Content Area (1)	Total Enrollment (2)	Maximum Group Size (3)	Total Weekly Periods or Modules (4)	Total Weekly Interaction Group-Periods or Modules (5)	Seminar Areas Required (5) ÷ (4) (6)	Adjusted Seminar Areas Required (6) X 1.3 (7)
II Manufacturing Processes	120	15	30	20	0.67	0.87
III Materials Testing						
IV Heat Treating						
V Metallography						
VI Instrumentation						
I Supporting Services						
Academic	240	15	30	30	1.00	1.30
Science	30	0	30	0	0	0
Music						
Physical Education	65	15	30	5	0.17	0.22
Other (specify)						

(8) Totals (Figures in Column 7 can be added together for areas with same student capacity as entered in Column 3.) Round up total to next higher whole number.

a. ___3___ seminar areas with a minimum student capacity of ___15___, each.
b. ________ seminar areas with a minimum student capacity of ________, each.
c. ________ seminar areas with a minimum student capacity of ________, each.
d. ________ seminar areas with a minimum student capacity of ________, each.

FORM C

SEMINAR AREA REQUIREMENTS BY CONTENT AREAS

Content Area (1)	Total Enrollment (2)	Maximum Group Size (3)	Total Weekly Periods or Modules (4)	Total Weekly Interaction Group-Periods or Modules (5)	Seminar Areas Required (5) ÷ (4) (6)	Adjusted Seminar Areas Required (6) X 1.3 (7)
II Manufacturing Processes						
III Materials Testing						
IV Heat Treating						
V Metallography						
VI Instrumentation						
I Supporting Services						
Academic						
Science						
Music						
Physical Education						
Other (specify)						

(8) Totals (Figures in Column 7 can be added together for areas with same student capacity as entered in Column 3.) Round up total to next higher whole number.

a. ________ seminar areas with a minimum student capacity of ________, each.
b. ________ seminar areas with a minimum student capacity of ________, each.
c. ________ seminar areas with a minimum student capacity of ________, each.
d. ________ seminar areas with a minimum student capacity of ________, each.

INSTRUCTIONS FOR COMPLETING FORM D
LABORATORY AREA REQUIREMENTS BY CONTENT AREAS

Column 1

Content Area--Content areas are listed in Column 1.

Column 2

Total Enrollment--To obtain total enrollment for content areas, find the total enrollment for each area as indicated in Columns 7 and 8 of Form A for all occupational preparation programs.

Column 3

Maximum Group Size--Opposite each content area, enter the maximum group size desired for a laboratory area to serve the content area (Form A, Column 15).

Column 4

Total Weekly Periods or Modules--Opposite each content area, enter the total periods or modules per week the school will be open for day school instruction. This entry will be identical for all content areas and identical to the number recorded for Item 5, Form A.

Column 5

Total Weekly Action Group Periods or Modules--Opposite each content area, enter the total group periods or modules per week to be devoted to action learning as indicated in Column 17 of Form A(s) for all occupational preparation programs.

Column 6

Laboratory Areas Required--Opposite each content area, enter the quotient of Item 5 divided by Item 4. Round up to the nearest hundredth.

Column 7

Adjusted Laboratory Areas Required--To adjust for scheduling difficulties which result in areas being less than 100 percent utilized, multiply the entry in Column 6 by 1.3 and enter the result, rounded up to the nearest hundredth, in Column 7 for each content area.

SAMPLE FORM D

LABORATORY AREA REQUIREMENTS BY CONTENT AREAS

Content Area (1)	Total Enrollment (2)	Maximum Group Size (3)	Total Weekly Periods or Modules (4)	Total Weekly Action Group-Periods or Modules (5)	Laboratory Areas Required (5) ÷ (4) (6)	Adjusted Laboratory Areas Required (6) X 1.3 (7)
I Supporting Services						
Academic	120	0	30	0	0	0
Science	30	15	30	9	0.30	0.39
Music						
Physical Education	65	20	30	12	0.40	0.52
Other (specify						
II Manufacturing Processes	120	25	30	39	1.30	1.70
III Materials Testing						
IV Heat Treating						
V Metallography						
VI Instrumentation						

FORM D

LABORATORY AREA REQUIREMENTS BY CONTENT AREAS

Content Area (1)	Total Enrollment (2)	Maximum Group Size (3)	Total Weekly Periods or Modules (4)	Total Weekly Action Group-Periods or Modules (5)	Laboratory Areas Required (5) ÷ (4) (6)	Adjusted Laboratory Areas Required (6) X 1.3 (7)
I Supporting Services						
Academic						
Science						
Music						
Physical Education						
Other (specify						
II Manufacturing Processes						
III Materials Testing						
IV Heat Treating						
V Metallography						
VI Instrumentation						

SAMPLE FORM E

SUMMARY OF FACILITY REQUIREMENTS FOR TECHNICIAN TRAINING PROGRAMS IN METALLURGY

	Instructional Areas	Number Required*		Required Student Capacity
		Calculated Forms B, C, D Column 7	Next Higher Whole Number	
	Lecture/Demonstration	*0.57*	*1*	*50*
	Lecture/Demonstration			
1	Lecture/Demonstration			
	Lecture/Demonstration			
	Seminar	*2.39*	*3*	*15*
2	Seminar			
	Seminar			
	Seminar			
	Manufacturing Process Laboratory	*1.70*	*2*	*25*
	Manufacturing Process Laboratory			
	Materials Testing Laboratory			
3	Heat Treating Laboratory			
	Metallography Laboratory			
	Instrumentation Laboratory			
	Science Laboratory			

4 Multi-purpose areas

If any of the specialized areas entered above are to be combined as multi-purpose areas, indicate the combinations desired.

a. *Combination manufacturing process laboratory & lecture/demonstration*
b. ____________________
c. ____________________
d. ____________________

5 Summary of facility requirements for metallurgy technology training program. Based on the above entries, summarize the total quantitative facility requirements for the planned program.

____
____
____

*Enter the number of instructional areas needed for each student capacity required. In the event that the numbers required indicate that an area will be used only sparingly, consideration should be given to sharing lecture/demonstration and seminar areas with other training programs or the construction of high student capacity areas which are capable of being subdivided for instructional purposes.

FORM E

SUMMARY OF FACILITY REQUIREMENTS FOR TECHNICIAN TRAINING PROGRAMS IN METALLURGY

	Instructional Areas	Number Required*		Required Student Capacity
		Calculated Forms B, C, D Column 7	Next Higher Whole Number	
	Lecture/Demonstration			
	Lecture/Demonstration			
1	Lecture/Demonstration			
	Lecture/Demonstration			
	Seminar			
	Seminar			
2	Seminar			
	Seminar			
	Manufacturing Process Laboratory			
	Manufacturing Process Laboratory			
	Materials Testing Laboratory			
3	Heat Treating Laboratory			
	Metallography Laboratory			
	Instrumentation Laboratory			
	Science Laboratory			

4 Multi-purpose areas

If any of the specialized areas entered above are to be combined as multi-purpose areas, indicate the combinations desired.

a.
b.
c.
d.

5 Summary of facility requirements for metallurgy technology training program. Based on the above entries, summarize the total quantitative facility requirements for the planned program.

*Enter the number of instructional areas needed for each student capacity required. In the event that the numbers required indicate that an area will be used only sparingly, consideration should be given to sharing lecture/demonstration and seminar areas with other training programs or the construction of high student capacity areas which are capable of being subdivided for instructional purposes.

QUALITATIVE FACILITY NEEDS

In this section, detailed information on the kind of instructional areas required is recorded. Special forms are provided for describing the nature of lecture/demonstration areas, seminar areas, laboratory areas, and auxiliary areas to be provided. For each general type of instructional area required information is sought in the following categories.

1. The relationship of the area to other instructional areas (specialized versus multi-purpose utilization of space).
2. The number of these kinds of areas needed.
3. The activities of students and teachers in the instructional area.
4. The spatial relationships within the area and the area's spatial relationships to other instructional areas and the building as a whole.
5. The furniture and equipment required for the area.
6. The environmental factors required for the area.
7. The special utility services required for the area.
8. The minimal space requirements for the area.

FORM F

DESCRIPTION OF LECTURE/DEMONSTRATION AREA(S) TO BE USED PRINCIPALLY FOR GROUP REACTION LEARNING

1 major emphasis
2 some emphasis
3 slight emphasis
N no emphasis

1. The lecture/demonstration area(s) should be planned:

a.	As independent unit(s)	Yes	No
b.	In combination with ________ laboratory area(s) (specify)	Yes	No
c.	In combination with seminar area(s)	Yes	No
d.	As an area within a single multi-use space	Yes	No

2. Number of lecture/demonstration areas required for the desired program (see Form E) ________

3. Student and teacher activities in this space. Indicate the extent to which each of the activities listed below will occur.

a.	Listening to lectures	1	2	3	N
b.	Observing demonstrations	1	2	3	N
c.	Taking notes	1	2	3	N
d.	Viewing films, slides, overhead projections, etc.	1	2	3	N
e.	________	1	2	3	N
f.	________	1	2	3	N

4. Spatial relationships. Indicate the extent to which the lecture/demonstration area(s) should be accessible to the:

a.	Instructional materials center	1	2	3	N
b.	Building entrance	1	2	3	N
c.	Delivery area	1	2	3	N
d.	Other instructional area				
	1) ________	1	2	3	N
	2) ________	1	2	3	N
	3) ________	1	2	3	N
e.	Other building areas				
	1) ________	1	2	3	N
	2) ________	1	2	3	N
	3) ________	1	2	3	N

5. Furniture and equipment

   a. Student seating

FORM F

1) Individual desks and chairs	P	A	NA*
a) Number of desks and chairs required	________		
b) Provision for storage	Yes		No
2) Permanent-type desk	P	A	NA
a) Number required	________		
b) Provision for storage	Yes		No
3) Desk and chair combination	P	A	NA
a) Number required	________		
b) Provision for storage	Yes		No
4) Tables and chairs	P	A	NA
a) Number of tables required	________		
b) Number of chairs required	________		
c) Provision for storage	Yes		No
5) Auditorium-type seating	P	A	NA
Number of seats required	________		
b. State	Yes		No
1) Permanent type	P	A	NA
2) Portable type	P	A	NA
The approximate area in square feet desired	________		
c. Sound amplifying system	P	A	NA
d. Controls for regulating light intensity	P	A	NA
e. Lectern			
1) Permanent type	P	A	NA
2) Portable type	P	A	NA
3) Provision for storage	Yes		No
f. Projection screen			
1) Built-in type	P	A	NA
2) Portable type	P	A	NA
3) Approximate dimensions	________		
4) Provision for storage	Yes		No

g. Other equipment requirements for lecture/demonstration area(s) are:

1) ______________________________
2) ______________________________
3) ______________________________
4) ______________________________

6. Environmental factors

a. Aesthetic. Factors to be considered in the aesthetic domain are colors, light, style of architecture, design and the like. Indicate any special aesthetic considerations important to the planning of the lecture/demonstration area(s).

____
____
____
____

---

*Code: P = Preferred; A = Acceptable; NA = Not acceptable. This scale is used frequently on the following pages.

b. Aerial. Factors to be considered in this category include air temperature, radiant temperature, relative humidity, and ventilation. Indicate any special considerations important to the planning of the lecture/demonstration area(s).

c. Visual. A properly controlled and balanced visual environment is important. The visual environment affects such things as accuracy in perception, attention to tasks, and speed of performance. Indicate any special factors which should be taken into account in planning the visual environment of the lecture/demonstration area(s).

d. Sonic. Factors to be considered in this category include such things as acoustical requirements and sound systems. Indicate any special consideration important to the planning of the lecture/demonstration area(s).

e. Safety. In planning a school building, safety for students and instructors is of prime concern. Indicate any special safety considerations which have implications for design of the lecture/demonstration area(s).

7. Vertical instructional surfaces

a. Chalkboard	Yes		No
1) Wall-mounted	P	A	NA
Number of lineal feet			
2) Portable	P	A	NA
Provision for storage	Yes		No
b. Tack board	Yes		No
Number of lineal feet			
c. Pegboard	Yes		No
Number of lineal feet			

8. Special utility services required

a. Electricity		
1) Projection equipment	Yes	No
2) Sound amplifying equipment	Yes	No
3) Electrical needs for other equipment (specify)	Yes	No

a) ______________________________
b) ______________________________
c) ______________________________
d) ______________________________

b. Other utility needs for the lecture/demonstration area(s)
1) ______________________________
2) ______________________________
3) ______________________________
4) ______________________________

9. The minimum space requirement in square feet for each lecture/demonstration area (optional). _______________ (The planner should be aware of any state or local regulation or recommendations concerning floor space requirements.)

10. Other important factors to be considered in the planning of the lecture/demonstration area(s) are:

FORM G

DESCRIPTION OF SEMINAR AREA(S) TO BE USED PRINCIPALLY FOR GROUP INTERACTION LEARNING

1 major emphasis
2 some emphasis
3 slight emphasis
N no emphasis

1. The seminar area(s) should be planned:

a. As independent unit(s)	Yes	No
b. In combination with ____________ laboratory area(s) (specify)	Yes	No
c. In combination with lecture/demonstration area(s)	Yes	No
d. As an area within a single multi-use area	Yes	No

2. The number of seminar area(s) required for the desired program (see Form E) ____________

3. Student and instructor activities in this space. Indicate the extent to which each of the activities listed below will occur.

a. Small group discussing	1	2	3	N
b. Viewing films, slides, overhead projections, etc.	1	2	3	N
c. Demonstrating	1	2	3	N
d. Reporting	1	2	3	N
e. Working on projects	1	2	3	N
f. ____________________________	1	2	3	N
g. ____________________________	1	2	3	N

4. Spatial relationships. Indicate the extent to which the seminar area(s) should be accessible to the:

a. Instructional materials center	1	2	3	N
b. Building entrance	1	2	3	N
c. Delivery area	1	2	3	N
d. Other instructional areas				
1) ________________________	1	2	3	N
2) ________________________	1	2	3	N
3) ________________________	1	2	3	N
e. Other building areas				
1) ________________________	1	2	3	N
2) ________________________	1	2	3	N
3) ________________________	1	2	3	N

5. Furniture and equipment

a. Seminar table	Yes	No
1) Number required	____________	
2) Seating for how many persons	____________	

3) Permanent type	P A NA
4) Portable type	P A NA
5) Provision for storage	Yes No
b. Chairs	Yes No
1) Number required	______
2) Straight-back type	P A NA
3) Folding type	P A NA
4) Provision for storage	Yes No

c. Other equipment requirements for seminar area(s) are:
1) ______________________
2) ______________________
3) ______________________
4) ______________________

6. Environmental factors

a. Aesthetic. Factors to be considered in the aesthetic domain are colors, light, style of architecture, design and the like. Indicate any special aesthetic considerations important to the planning of seminar areas.

____
____
____

b. Aerial. Factors to be considered in this category include air temperature, radiant temperature, relative humidity, and ventilation. Indicate any special considerations important to the planning of the seminar area(s).

____
____
____

c. Visual. A properly controlled and balanced visual environment is important. The visual environment affects such things as accuracy in perception, attention to tasks, and speed of performance. Indicate any special factors which should be taken into account in planning the visual environment of the seminar area(s).

____
____
____

d. Sonic. Factors to be considered in this category include such things as acoustical requirements and sound system. Indicate any special considerations important to the planning of the seminar area(s).

____
____
____

e. Safety. In planning a school building, safety for students and instructors is of prime concern. Indicate any special safety considerations which have implications for design of the seminar area(s).

____
____
____

FORM G

7. Vertical instructional surfaces

a. Chalkboard	Yes		No
1) Wall-mounted	P	A	NA
Number of lineal feet	________		
2) Portable	P	A	NA
Provision for storage	Yes		No
b. Tack board	Yes		No
Number of lineal feet	________		
c. Pegboard	Yes		No
Number of lineal feet	________		

8. Special utility services required

a. Electricity		
1) Projection equipment	Yes	No
2) Sound amplifying equipment	Yes	No

3) Electrical needs for other equipment (specify)

a) ____________________

b) ____________________

c) ____________________

d) ____________________

b. Other utility needs for the seminar area(s)

1) ____________________

2) ____________________

3) ____________________

4) ____________________

9. Minimum space requirement in square feet for each seminar area (optional). ____________
(The planner should be aware of any state or local regulations or recommendations concerning floor space requirements.)

10. Other important factors to be considered in the planning of the seminar area(s) are:

____
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____

FORM H-1

DESCRIPTION OF MANUFACTURING PROCESSES LABORATORY AREA(S) TO BE USED PRINCIPALLY FOR ACTION LEARNING (MACHINE SHOP AREA)

1 major emphasis
2 some emphasis
3 slight emphasis
N no emphasis

1. The machine shop area(s) should be planned:

a. As independent unit(s)	Yes	No
b. In combination with ______ laboratory area(s) (specify)	Yes	No
c. In combination with seminar area(s)	Yes	No
d. In combination with lecture/demonstration area(s)	Yes	No
e. As an area within a single multi-use area	Yes	No
f. As a building and grounds maintenance facility	Yes	No

2. Student capacity required for scheduled activities (see Form E) ______

3. Spatial relationships. Indicate the extent to which spaces should be accessible to each other.

a. Within the manufacturing processes laboratory area(s)				
1) Machine shop area to				
a) Foundry area	1	2	3	N
b) Metal Forming area	1	2	3	N
2) Foundry area to Metal forming area	1	2	3	N
b. Machine shop laboratory area(s) to				
1) Instructional materials center	1	2	3	N
2) Building entrance	1	2	3	N
3) Delivery area	1	2	3	N
4) Other instructional areas (specify)				
a) ______	1	2	3	N
b) ______	1	2	3	N
c) ______	1	2	3	N
d) ______	1	2	3	N
5) Other building areas (specify)				
a) ______	1	2	3	N
b) ______	1	2	3	N
c) ______	1	2	3	N
d) ______	1	2	3	N

4. Equipment and furniture

a. Lathes	Yes	No
Specify type and number required	______	

____ ____________
____ ____________
____ ____________

b. Grinders — Yes No
Specify type and number required
____ ____________
____ ____________
____ ____________

c. Drill presses — Yes No
Specify type and number required
____ ____________
____ ____________
____ ____________

d. Milling machines — Yes No
1) Specify types and number required
____ ____________
____ ____________
2) Specify type of accessory tape control equipment if desired:
____
____

e. Electric discharge machining equipment — Yes No
Specify type and number required
____ ____________

f. Chemical milling equipment — Yes No
Specify type and number required
____ ____________

g. Band saws — Yes No
Specify type and number required
____ ____________
____ ____________
____ ____________

h. Layout and inspection equipment (ex. micrometers, calipers, comparator, layout plates, surface gages, optical flats, etc.) — P A NA
Specify type and number required
____ ____________
____ ____________
____ ____________
____ ____________
____ ____________
____

i. Tool crib — Yes No
1) Number required ____________
2) Floor area required ____sq.ft.

j. Work benches — Yes No
Specify type and lineal feet required
________ft.
____ ________ft.
____ ________ft.
____

k. Stock rack — Yes No
Specify type and number required
____ ____________
____ ____________

FORM H-1

l. Filing cabinets			
1) Legal-size drawers	Yes		No
Number of drawers required			
2) Letter-size drawers	Yes		No
Number of drawers required			
m. Magazine racks	Yes		No
1) Number required			
2) Provision for storage	Yes		No
n. Provision for darkening area(s)			
1) Opaque blinds	P	A	NA
2) Flexible room partitions	P	A	NA
Provision for storage	Yes		No
o. Projection screen			
1) Wall-mounted	P	A	NA
2) Portable	P	A	NA
Provision for storage	Yes		No
p. Student seating			
1) Individual stools	P	A	NA
2) Other (specify)	P	A	NA
q. Built-in locker for storage of students' coats, etc.	P	A	NA

r. Other equipment required for machine shop area (ex. vises, hand tools, etc.)
1)
2)
3)
4)

5. Environmental factors

a. Aesthetic. Factors to be considered in the aesthetic domain are colors, light, style of architecture, design and the like. Indicate any special aesthetic considerations important to the planning of the machine shop laboratory area(s).

b. Aerial. Factors to be considered in this category include air temperature, radiant temperature, relative humidity, and ventilation. Indicate any special considerations important to the planning of the machine shop laboratory area(s).

c. Visual. A properly controlled and balanced visual environment is important. The visual environment affects such things as accuracy in perception, attention to tasks, and speed of performance. Indicate any special factors which should be taken into account in planning the visual environment of the machine shop laboratory area(s).

d. Safety. In planning school buildings, safety for students and instructors is of prime concern. Indicate any special safety considerations which have implications of the machine shop laboratory area(s).

6. Vertical instructional surfaces

a. Chalkboard	Yes		No
1) Wall-mounted	P	A	NA
Number of lineal feet	______		
2) Portable	P	A	NA
a) Number of lineal feet	______		
b) Provision for storage	Yes		No
b. Tack board	Yes		No
Number of lineal feet	______		
c. Pegboard	Yes		No
Number of lineal feet	______		

7. Special utility services required

a. Electricity

1) Motor driven machines

a) 110 V AC	Yes	No
b) 220 V AC, single phase	Yes	No
c) 220 V AC, three phase	Yes	No

2) Special lighting requirements (specify)

a) ______
b) ______
c) ______
d) ______

3) Electrical needs for other equipment (specify)

a) ______
b) ______
c) ______
d) ______

b. Compressed air	Yes	No
c. Water		
1) Drinking fountain(s)	Yes	No
2) Sinks	Yes	No
3) Toilets	Yes	No
4) Other (specify) ______		

8. Minimum space requirements in square feet

FORM H-1

Floor area in square feet for entire machine shop laboratory area ____________

9. Other important factors to be considered in the planning of the machine shop laboratory area(s) are: (ex. separate master electrical distribution panel)

FORM H-2

DESCRIPTION OF MANUFACTURING PROCESSES LABORATORY AREA(S) TO BE USED PRINCIPALLY FOR ACTION LEARNING
(FOUNDRY AREA)

1 major emphasis
2 some emphasis
3 slight emphasis
N no emphasis

1. The foundry area(s) should be planned:

a. As independent unit(s)	Yes	No
b. In combination with ________ laboratory area(s) (specify)	Yes	No
c. In combination with seminar area(s)	Yes	No
d. In combination with lecture/demonstration area(s)	Yes	No
e. As an area within a single multi-use area(s)	Yes	No

2. Student capacity required for scheduled activities (see Form E) ____________

3. Spatial relationships. Indicate the extent to which spaces whould be accessible to each other.

a. Within the manufacturing processes laboratory area(s)				
1) Foundry area to				
a) Machine shop area	1	2	3	N
b) Metal forming area	1	2	3	N
2) Machine shop area to Metal forming area	1	2	3	N
b. Foundry laboratory area(s) to				
1) Instructional materials center	1	2	3	N
2) Building entrance	1	2	3	N
3) Delivery area	1	2	3	N
4) Other instructional areas				
a) ____________________	1	2	3	N
b) ____________________	1	2	3	N
c) ____________________	1	2	3	N
5) Other building areas				
a) ____________________	1	2	3	N
b) ____________________	1	2	3	N
c) ____________________	1	2	3	N

4. Equipment and furniture

a. Metal melting furnaces Specify type(s) and number required	Yes	No
____________________	____________	
____________________	____________	
____________________	____________	

FORM H-2

b. Sand conditioning and mixing equipment (for molding sand and/or core sand) — Yes No
   Specify type(s) and number required
   ______________________________ ________
   ______________________________ ________
   ______________________________ ________
   ______________________________ ________

c. Core baking ovens — Yes No
   Specify type(s) and number required
   ______________________________ ________
   ______________________________ ________

d. Testing and control equipment for molding and core sands, molds and cores — Yes No
   Specify type(s) and number required
   ______________________________ ________
   ______________________________ ________
   ______________________________ ________
   ______________________________ ________
   ______________________________ ________
   ______________________________ ________

e. Molding machine(s) — Yes No
   Specify type(s) and number required
   ______________________________ ________
   ______________________________ ________
   ______________________________ ________
   ______________________________ ________

f. Sand blast equipment — Yes No
   Specify type
   ____

g. Work benches — Yes No
   Specify type(s) and lineal feet required
   ______________________________ ________
   ______________________________ ________
   ______________________________ ________

h. Equipment and pattern storage racks — Yes No
   Specify type(s) and number required
   ______________________________ ________
   ______________________________ ________

i. Student seating
   1) Mobile collapsible bleachers — P A NA
      a) Specify type
         ____
      b) Provision for storage — Yes No
   2) Other (describe) ______________ — P A NA
   ____

j. Built in lockers for storage of students' coats, etc. — Yes No

k. Other equipment required for foundry area (ex. flasks, tongs, shovels, crucibles, platform scales, pyrometers, vibrators, safety clothing, etc.)
   1) ______________________________
   2) ______________________________

FORM H-2

3) ______________________________
4) ______________________________
5) ______________________________
6) ______________________________

5. Environmental factors

a. Aesthetic. Factors to be considered in the aesthetic domain are colors, light, style of architecture, design and the like. Indicate any special aesthetic considerations important to the planning of the foundry area(s).

b. Aerial. Factors to be considered in this category include air temperature, radiant temperature, relative humidity, and ventilation. Indicate any special considerations important to the planning of the foundry area(s).

c. Visual. A properly controlled and balanced visual environment is important. The visual environment affects such things as accuracy in perception, attention to tasks, and speed of performance. Indicate any special factors which should be taken into account in planning the visual environment of the foundry area(s).

d. Sonic. Factors to be considered in this category include such things as acoustical requirements and sound systems. Indicate any special considerations important to the planning of the foundry area(s).

e. Safety. In planning school buildings, safety for students and instructors is of prime concern. Indicate any special considerations which have implications for design of the foundry area(s).

6. Vertical instructional surfaces

	Yes		No
a. Chalkboard	P	A	NA
1) Wall-mounted			

FORM H-2

Number of lineal feet ____________
2) Portable P A NA
a) Number of lineal feet ____________
b) Provision for storage Yes No
b. Tack board Yes No
Number of lineal feet ____________
c. Pegboard Yes No
Number of lineal feet ____________

7. Minimum floor areas required in square feet

a. Floor area in square feet for the entire foundry area ____________________________
b. If distinct space divisions are desired according to function give minimum floor area requirements in square feet for each of the following areas if included in the desired program.
1) Storage space
a) Sand ____________
b) Sand Binders ____________
c) Metal ingot and scrap ____________
2) Core making area ____________
3) Moulding area ____________
4) Melting and pouring area ____________
5) Crucible cleaning and coating area ____________
6) ____________
7) ____________
8) ____________

8. Special utility services required

a. Electricity
1) Motor driven machines
a) 110 V AC Yes No
b) 220 V AC, single phase Yes No
c) 220 V AC, three phase Yes No
2) Metal melting furnaces
440 V AC Yes No
3) Special lighting requirements (specify)
a) ____________________________
b) ____________________________
c) ____________________________
d) ____________________________
4) Electrical needs for other equipment (specify)
a) ____________________________
b) ____________________________
c) ____________________________
d) ____________________________
b. Compressed air
1) High pressure Yes No
2) Low pressure Yes No
c. Fuel oil Yes No

FORM H-2

d.	Gas	Yes	No
e.	Water		
	1) Sand conditioning	Yes	No
	2) Drinking fountains	Yes	No
	3) Sinks	Yes	No
	4) Toilets	Yes	No
	5) Other (specify) ________________		

9. Other important factors to be considered in the planning of the foundry laboratory area(s) are: (ex. separate master electrical distribution panel)

FORM H-3

DESCRIPTION OF MANUFACTURING PROCESSES LABORATORY AREA(S) TO BE USED PRINCIPALLY FOR ACTION LEARNING
(METAL FARMING AREA)

1 major emphasis
2 some emphasis
3 slight emphasis
N no emphasis

1. The metal forming area(s) should be planned:

    a. As independent unit(s) — Yes No
    b. In combination with ________ (specify) laboratory area(s) — Yes No
    c. In combination with seminar area(s) — Yes No
    d. In combination with lecture/demonstration area(s) — Yes No
    e. As an area within a single multi-use area — Yes No

2. Student capacity required for scheduled activities (see Form E) ________

3. Spatial relationships. Indicate the extent to which spaces should be accessible to each other.

    a. Within the manufacturing processes laboratory area(s)
        1) Metal forming area to
            a) Machine shop — 1 2 3 N
            b) Foundry — 1 2 3 N
        2) Machine shop to
            a) Foundry — 1 2 3 N
    b. The metal forming laboratory area to
        1) Instructional materials center — 1 2 3 N
        2) Building entrance — 1 2 3 N
        3) Delivery area — 1 2 3 N
        4) Other instructional areas
            a) ________ — 1 2 3 N
            b) ________ — 1 2 3 N
            c) ________ — 1 2 3 N
        5) Other building areas (specify)
            a) ________ — 1 2 3 N
            b) ________ — 1 2 3 N
            c) ________ — 1 2 3 N

4. Equipment and furniture

    a. Rolling mill — Yes No
        Specify type(s) and number required
        ________ ________
        ________ ________
        ________ ________

2

FORM H-3

b. Presses (metal stamping and/or metal powder briquetting) Yes No
Specify type(s) and number required

c. Swaging equipment Yes No
Specify type(s) and number required

d. Magneforming equipment Yes No
Specify type(s) and number required

e. Wire drawing bench Yes No
Specify type(s) and number required

f. Shearing press Yes No
Specify type(s) and number required

g. Press brake Yes No
Specify type(s) and number required

h. Ovens (preheating and annealing) Yes No
Specify type(s) and number required

i. Hardness testers Yes No
Specify type(s) and number required

j. Welding equipment Yes No
Specify type(s) and number required

k. Work benches Yes No
Specify type(s) and lineal feet required

l. Welding booths Yes No
Specify type and number required

m. Storage racks Yes No
Specify type and number required

n. Student seating Yes No
1) Stools P A NA
Specify type(s) and number required

FORM H-3

2) Other (describe) P A NA

____

o. Built in lockers for storage of students' coats, etc. Yes No

p. Other equipment required for metal forming laboratory (ex. tongs, micrometers, anvil, pyrometers, hand tools, etc.)

1) ______________________________
2) ______________________________
3) ______________________________
4) ______________________________
5) ______________________________
6) ______________________________

5. Environmental factors

a. Aesthetic. Factors to be considered in the aesthetic domain are colors, light, style of architecture, design and the like. Indicate any special aesthetic considerations important to the planning of the metal forming area(s).

____
____
____

b. Aerial. Factors to be considered in this category include air temperature, radiant temperature, relative humidity, and ventilation. Indicate any special considerations important to the planning of the metal forming area(s).

____
____
____

c. Visual. A properly controlled and balanced visual environment is important. The visual environment affects such things as accuracy in perception, attention to tasks, and speed of performance. Indicate any special factors which should be taken into account in planning the visual environment of the metal forming area(s).

____
____
____

d. Sonic. Factors to be considered in this category include such things as acoustical requirements and sound systems. Indicate any special considerations important to the planning of the metal forming area(s).

____
____
____

e. Safety. In planning a school building, safety for students and instructors is of prime concern. Indicate any special safety considerations which have implications for design of the metal forming area(s).

____
____
____

FORM H-3

6. Vertical instructional surfaces

    a. Chalkboard — Yes No
        1) Wall-mounted — P A NA
            Number of lineal feet ________
        2) Portable — P A NA
            a) Number of lineal feet ________
            b) Provision for storage — Yes No
    b. Tack board — Yes No
        Number of lineal feet ________
    c. Pegboard — Yes No
        Number of lineal feet ________

7. Minimum space requirement in square feet for the metal forming laboratory area(s). ________

8. Special utility services required

    a. Electricity
        1) Motor driven machines
            a) 110 V AC — Yes No
            b) 220 V AC, single phase — Yes No
            c) 220 V AC, three phase — Yes No
        2) Special lighting equipment (specify)
            a) ________________________
            b) ________________________
            c) ________________________
            d) ________________________
        3) Electrical needs for other equipment (specify)
            a) ________________________
            b) ________________________
            c) ________________________
            d) ________________________
    b. Compressed air
        1) High pressure — Yes No
        2) Low pressure — Yes No
    c. Gas — Yes No
    d. Water
        1) Drinking fountains — Yes No
        2) Sinks — Yes No
        3) Toilets — Yes No
        4) Other (specify) ________________
            ____

9. Other important factors to be considered in the planning of the metal forming area(s) are:

____
____
____
____
____
____
____

FORM I

DESCRIPTION OF MATERIALS TESTING LABORATORY AREA(S) TO BE USED PRINCIPALLY FOR ACTION LEARNING

1 major emphasis
2 some emphasis
3 slight emphasis
N no emphasis

1. The materials testing laboratory area(s) should be planned:

a.	As independent unit(s)	Yes	No
b.	In combination with ________ (specify) laboratory area(s)	Yes	No
c.	In combination with lecture/demonstration area(s)	Yes	No
d.	In combination with seminar area(s)	Yes	No
e.	As an area within a single multi-use area	Yes	No

2. Student capacity required for scheduled activities (see Form E) ________

3. Spatial relationships. Indicate the extent to which spaces should be accessible to each other. The materials testing laboratory area(s) to:

a.	Instructional material center	1	2	3	N
b.	Building entrance	1	2	3	N
c.	Delivery area	1	2	3	N
d.	Other building areas				
	1) ____________________	1	2	3	N
	2) ____________________	1	2	3	N
	3) ____________________	1	2	3	N
e.	Other instructional areas				
	1) ____________________	1	2	3	N
	2) ____________________	1	2	3	N
	3) ____________________	1	2	3	N

4. Equipment and furniture

a. Tensile-compression testers — Yes No

Specify type(s) and number required

____________________ ________
____________________ ________
____

b. Impact testers — Yes No

Specify type(s) and number required

____________________ ________
____

c. Torsion testers — Yes No

Specify type(s) and number required

____________________ ________
____________________ ________

FORM I

d. Hardness testers — Yes No
Specify type(s) and number required

e. Fatigue testers — Yes No
Specify type(s) and number required

f. Creep testers — Yes No
Specify type(s) and number required

g. Ultrasonic tester — Yes No
Specify type(s) and number required

h. Eddy current tester — Yes No
Specify type(s) and number required

i. Magnetic particle tester — Yes No
Specify type(s) and number required

j. Corrosion chamber — Yes No
Specify type required

k. Electric strain gage readout equipment — Yes No
Specify type required

l. Radiographic equipment — Yes No
Specify type required

m. X-ray film processing darkroom — Yes No
Specify size ____________

n. Work benches — Yes No
Specify type(s) and lineal feet required

o. Storage cabinets — Yes No
Specify type(s) and number required

p. Student seating
1) Stools — P A NA
Specify type(s) and number required

2) Other (describe) — P A NA

q. Built in lockers for storage of students' coats, etc. — Yes No

r. Other equipment required for materials testing laboratory (ex. extensometers,

FORM I

micrometers, hand tools, polarized light source, fluorescent penetrant kit, etc.)
1) ______________________________
2) ______________________________
3) ______________________________
4) ______________________________
5) ______________________________
6) ______________________________

5. Special utility services required

   a. Electricity
      1) Motor driven machines
         a) 110 V AC — Yes No
         b) 220 V AC, single phase — Yes No
      2) Special lighting requirements (specify)
         a) ______________________________
         b) ______________________________
         c) ______________________________
         d) ______________________________
      3) Electrical needs for other equipment (specify)
         a) ______________________________
         b) ______________________________
         c) ______________________________
         d) ______________________________
   b. Compressed air — Yes No
   c. Gas — Yes No
   d. Water
      1) Drinking fountains — Yes No
      2) Sinks — Yes No
      3) Toilets — Yes No
      4) Other (specify) __________________
      ____

6. Environmental factors

   a. Aesthetic. Factors to be considered in the aesthetic domain are color, light, style of architecture, design and the like. Indicate any special aesthetic considerations important to the planning of the materials testing laboratory area(s).

   ____
   ____
   ____

   b. Aerial. Factors to be considered in this category include air temperature, radiant temperature, relative humidity, and ventilation. Indicate any special considerations important to the planning of the materials testing laboratory area(s).

   ____
   ____
   ____
   ____

FORM I

c. Visual. A properly controlled and balanced visual environment is important. The visual environment affects such things as accuracy in perception, attention to tasks, and speed of performance. Indicate any special factors which should be taken into account in planning the visual environment of the materials testing laboratory area(s).

____
____
____

d. Sonic. Factors to be considered in this category include such things as acoustical requirements and sound system. Indicate any special considerations important to the planning of the materials testing laborabory area(s).

____
____
____

e. Safety. In planning school buildings, safety for students and instructors is of prime concern. Indicate any special safety considerations which have implications for design of the materials testing laboratory area(s). Radiation hazards-radiography equipment.

____
____
____
____

7. Vertical instructional surfaces

a. Chalkboard	Yes		No
1) Wall-mounted	P	A	NA
Number of lineal feet	________		
2) Portable	P	A	NA
a) Number of lineal feet	________		
b) Provisions for storage	Yes		No
b. Tack board	Yes		No
Number of lineal feet	________		
c. Pegboard	Yes		No
Number of lineal feet	________		

8. Minimum floor areas required in square feet

a. Floor area in square feet for the entire materials testing laboratory area(s)	________
b. If distinct space divisions are desired according to function, give minimum floor area requirement in square feet for each of the following areas, if included in the desired program.	
1) Laboratory space	________
2) Darkroom	________
3) ______________________	________
4) ______________________	________

FORM I

9. Other important factors to be considered in the planning of the materials testing laboratory area(s).

FORM J

DESCRIPTION OF HEAT TREATING LABORATORY AREA(S) TO BE USED PRINCIPALLY FOR ACTION LEARNING

1 major emphasis
2 some emphasis
3 slight emphasis
N no emphasis

1. The heat treating laboratory area(s) should be planned:

   a. As independent unit(s) Yes No
   b. In combination with ________ (specify) laboratory area(s) Yes No
   c. In combination with lecture/demonstration area(s) Yes No
   d. In combination with seminar area(s) Yes No
   e. As an area within a single multi-use area(s) Yes No

2. Student capacity required for scheduled activities (see Form E) ________

3. Spatial relationships. Indicate the extent to which spaces should be accessible to each other. The heat treating laboratory area(s) to:

   a. Instructional material center 1 2 3 N
   b. Building entrance 1 2 3 N
   c. Delivery area 1 2 3 N
   d. Other building area
      1) ________________ 1 2 3 N
      2) ________________ 1 2 3 N
      3) ________________ 1 2 3 N
   e. Other instructional areas
      1) ________________ 1 2 3 N
      2) ________________ 1 2 3 N
      3) ________________ 1 2 3 N

4. Equipment and furniture

   a. Muffle furnaces Yes No
      Specify type(s) and number required
      ________________ ________
      ________________ ________
      ________________ ________
   b. Combustion tube furnaces Yes No
      1) Specify type(s) and number required
      ________________ ________
      ________________ ________
      ________________ ________
      2) Provision for atmosphere control Yes No

FORM J

c. Recirculating (forced draft) ovens Yes No
Specify type(s) and number required
____________________ ________
____________________ ________
____________________ ________

d. High vacuum equipment for melting, heat treating, and sputtering Yes No
Specify type(s) and number required
____________________ ________
____________________ ________
____________________ ________

e. Molten salt furnaces Yes No
Specify type(s) and number required
____________________ ________
____________________ ________
____________________ ________

f. Quench tanks Yes No
Specify type(s) and number required
____________________ ________
____________________ ________
____________________ ________

g. Atmosphere generator Yes No
Specify type(s) and number required
____________________ ________
____________________ ________

h. Instrumentation (temperature and atmosphere controls and recorders) Yes No
Specify type(s) and number required
____________________ ________
____________________ ________
____________________ ________

i. Hardness testers Yes No
Specify type(s) and number required
____________________ ________
____________________ ________

j. Work benches Yes No
Specify type(s) and number required
____________________ ________
____________________ ________

k. Student seating
1) Individual stools P A NA
2) Other (describe) P A NA
____________________ P A NA

l. Built in lockers for storage of students' coats, etc. Yes No

m. Other major equipment needs for the heat treating laboratory area(s). (ex. belt grinder vises, tongs, asbestos gloves, face shield, etc.)
____
____
____
____

FORM J

6. Environmental factors

   a. Aesthetic. Factors to be considered in the aesthetic domain are color, light, style of architecture, design and the like. Indicate any special aesthetic considerations important to the planning of the heat treating laboratory area(s).

   b. Aerial. Factors to be considered in this category include air temperature, radiant temperature, relative humidity, and ventilation. Indicate any special considerations important to the planning of the heat treating laboratory area(s).

   c. Visual. A properly controlled and balanced visual environment is important. The visual environment affects such things as accuracy in perception, attention to tasks, and speed of performance. Indicate any special factors which should be taken into account in planning the visual environment of the heat treating laboratory area(s).

   d. Sonic. Factors to be considered in this category include such things as acoustical requirements and sound system. Indicate any special considerations important to the planning of the heat treating laboratory area(s).

   e. Safety. In planning school buildings, safety for students and instructors is of prime concern. Indicate any special safety considerations which have implications for design of the heat treating laboratory area(s).

7. Special utility services required

   a. Electricity
      1) Motor driven machines
         a) 110 V AC — Yes No
         b) 220 V AC, single phase — Yes No
         c) 220 V AC, three phase — Yes No

FORM J

2) Special lighting requirements (specify)
a) ____________________
b) ____________________
c) ____________________
d) ____________________
3) Electrical needs for other equipment (specify)
a) ____________________
b) ____________________
c) ____________________
d) ____________________

b. Compressed air	Yes	No
c. Gas	Yes	No
d. Fuel oil	Yes	No
e. Water		
1) Drinking fountains	Yes	No
2) Sinks	Yes	No
3) Toilets	Yes	No
4) Other (specify) ____________________ ____________________		

8. Vertical instructional surfaces

a. Chalkboard	Yes		No
1) Wall-mounted	P	A	NA
Number of lineal feet	______		
2) Portable	P	A	NA
Number of lineal feet	______		
b. Tack board	Yes		No
Number of lineal feet	______		
c. Pegboard	Yes		No
Number of lineal feet	______		

9. Minimum floor areas required in square feet

a. Floor area in square feet for the entire heat treating laboratory area(s) ______
b. If distinct space divisions are desired according to function, give minimum floor area requirement in square feet for each of the following areas, if included in the desired program.
1) Laboratory space ______
2) Classroom ______
3) ____________________ ______
4) ____________________ ______
5) ____________________ ______

10. Other important factors to be considered in the planning of the heat treating laboratory area(s).

____
____
____
____

FORM K

DESCRIPTION OF THE METALLOGRAPHIC LABORATORY AREA(S) TO BE USED PRINCIPALLY FOR ACTION LEARNING

1 major emphasis
2 some emphasis
3 slight emphasis
N no emphasis

1. The metallographic laboratory area(s) should be planned:

a. As independent unit(s)	Yes	No
b. In combination with ____________ laboratory area(s) (specify)	Yes	No
c. In combination with lecture/demonstration area(s)	Yes	No
d. In combination with seminar area(s)	Yes	No
e. As an area within a single multi-use area	Yes	No

2. Student capacity required for scheduled activities (see Form E) ____________

3. Spatial relationships. Indicate the extent to which spaces should be accessible to each other. The metallographic laboratory area(s) to:

a. Instructional material center	1	2	3	N
b. Building entrance	1	2	3	N
c. Delivery area	1	2	3	N
d. Other building areas				
1) ________________________________	1	2	3	N
2) ________________________________	1	2	3	N
3) ________________________________	1	2	3	N
e. Other instructional areas				
1) ________________________________	1	2	3	N
2) ________________________________	1	2	3	N
3) ________________________________	1	2	3	N

4. Equipment and furniture

a. Specimen cut-off machines	Yes	No

Specify type(s) and number required

________________________________ ____________
________________________________ ____________
________________________________ ____________

b. Grinders (disc and/or hand)	Yes	No

Specify type(s) and number required

________________________________ ____________
________________________________ ____________
________________________________ ____________

c. Polishers

1) Variable speed rotary	P	A	NA

Specify type(s) and number required

________________________________ ____________
________________________________ ____________

FORM K

2) Vibratory	P A NA
Specify type(s) and number required	
d. Sonic cleaner	Yes No
Specify type(s) and number required	
e. Electrolytic polisher and/or etcher	Yes No
Specify type(s) and number required	
f. Metallurgical microscopes	Yes No
1) Specify type(s) and number required	
2) Television camera attachment	Yes No
3) Stereo microscope with polaroid attachment	Yes No
Specify type	
g. Metallograph	Yes No
Specify type	
h. Specimen mount press	Yes No
Specify type(s) and number required	
i. Hardness testers	Yes No
1) Specify type(s) and number required	
j. 2) Micro-hardness adapter for metallograph	Yes No
j. Work benches	Yes No
Specify type(s) and lineal feet required	
k. Storage cabinets	Yes No
Specify types and number required	
l. Photographic darkroom	Yes No
1) Specify size	
2) Location for metallograph	Yes No
m. Student seating	
1) Stools	P A NA
Specify type(s) and number required	
2) Other (describe)	P A NA
n. Built in lockers for storage of students' coats, etc.	Yes No

o. Other equipment required for metallographic laboratory (ex. hand tools, vises, photo developing and enlarging and printing equi equipment, specimen storage cabinet, etc.)
   1) ______________________________
   2) ______________________________
   3) ______________________________
   4) ______________________________
   5) ______________________________
   6) ______________________________

5. Special utility services required

   a. Electricity
      1) Motor driven machines
         a) 110 V AC — Yes No
         b) 220 V AC, single phase — Yes No
      2) Special lighting requirements (specify)
         a) ___________________________
         b) ___________________________
         c) ___________________________
         d) ___________________________
      3) Electrical needs for other equipment (specify)
         a) ___________________________
         b) ___________________________
         c) ___________________________
         d) ___________________________
   b. Compressed air — Yes No
   c. Water
      1) Drinking fountains — Yes No
      2) Sinks — Yes No
      3) Toilets — Yes No
      4) Other (specify) _______________

6. Environmental factors

   a. Aesthetic. Factors to be considered in the aesthetic domain are color, light, style of architecture, design and the like. Indicate any special aesthetic considerations important to the planning of the metallographic laboratory area(s).

   ____

   b. Aerial. Factors to be considered in this category include air temperature, radiant temperature, relative humidity, and ventilation. Indicate any special considerations important to the planning of the metallographic laboratory area(s).

c. Visual. A properly controlled and balanced visual environment is important. The visual environment affects such things as accuracy in perception, attention to tasks, and speed of performance. Indicate any special factors which should be taken into account in planning the visual environment of the metallographic laboratory area(s).

d. Sonic. Factors to be considered in this category include such things as acoustical requirements and sound system. Indicate any special considerations important to the planning of the metallographic laboratory area(s).

e. Safety. In planning school buildings, safety for students and instructors is of prime concern. Indicate any special safety considerations which have implications for design of the metallographic laboratory area(s).

7. Vertical instructional surfaces

a. Chalkboard	Yes		No
1) Wall-mounted	P	A	NA
Number of lineal feet			
2) Portable	P	A	NA
a) Number of lineal feet			
b) Provision for storage	Yes		No
b. Tack board	Yes		No
Number of lineal feet			
c. Pegboard	Yes		No
Number of lineal feet			

8. Minimum floor areas required in square feet

a. Floor area in square feet for the entire metallographic laboratory area(s)

b. If distinct space divisions are desired according to function, give minimum floor area requirement in square feet for each of the following areas, if included in the desired program.

1) Laboratory space ________
2) Classroom ________
3) ______________________ ________
4) ______________________ ________
5) ______________________ ________

9. Other important factors to be considered in the planning of the metallographic laboratory area(s): (ex. provision for darkening area)

FORM L

DESCRIPTION OF INSTRUMENTATION LABORATORY AREA(S) TO BE USED PRINCIPALLY FOR ACTION LEARNING

1 major emphasis
2 some emphasis
3 slight emphasis
N no emphasis

1. The instrumentation laboratory area(s) should be planned:
   - a. As independent unit(s) — Yes No
   - b. In combination with ____________ laboratory area(s) (specify) — Yes No
   - c. In combination with lecture/demonstration area(s) — Yes No
   - d. In combination with seminar area(s) — Yes No
   - e. As an area within a single multi-use area — Yes No

2. Student capacity required for scheduled activities (see Form E) ____________

3. Spatial relationships. Indicate the extent to which spaces should be accessible to each other. The instrumentation laboratory area(s) to:
   - a. Instructional material center — 1 2 3 N
   - b. Building entrance — 1 2 3 N
   - c. Delivery area — 1 2 3 N
   - d. Other building areas
     - 1) ____________________ 1 2 3 N
     - 2) ____________________ 1 2 3 N
     - 3) ____________________ 1 2 3 N
   - e. Other instructional areas
     - 1) ____________________ 1 2 3 N
     - 2) ____________________ 1 2 3 N
     - 3) ____________________ 1 2 3 N

4. Equipment and furniture
   - a. Atomic absorption spectrophotometer — Yes No
     Specify type ____________________
   - b. Ultra-violet and visible light spectrophotometer — Yes No
     Specify type ____________________
   - c. Emission spectrograph — Yes No
     Specify type ____________________
   - d. Densitometer — Yes No
     Specify type ____________________

FORM L

e. Bunsen spectroscopes — Yes No
Specify type(s) and number required
______________________________ __________
______________________________ __________

f. X-ray diffraction (basic unit) — Yes No
Specify type
____

g. X-ray diffractometer — Yes No
Specify type
____

h. Dilatometer — Yes No
Specify type(s) and number required
______________________________ __________
______________________________ __________

i. Vapor fractometer — Yes No
Specify type
____

j. ORSAT gas analyzer — Yes No
Specify type(s) and number required
______________________________ __________
______________________________ __________

k. Microderm thickness tester (betascope) — Yes No
Specify type and number required
______________________________ __________

l. Electrographic porosity checker — Yes No
Specify type and number required
______________________________ __________

m. Film processing darkroom — Yes No
Specify size ____________________

n. Work benches — Yes No
Specify type(s) and lineal feet required
______________________________ __________
______________________________ __________

o. Storage cabinets — Yes No
Specify type(s) and number required
______________________________ __________
______________________________ __________

p. Student seating
1) Stools — P A NA
Specify type(s) and number required
______________________________ __________
______________________________ __________

2) Other (describe) — P A NA
____
____

q. Built in lockers for storage of students' coats, etc. — Yes No

r. Other equipment required for instrumentation laboratory (ex. balances, chemical glassware, monochromatic light sources, etc.)
1) ______________________________
2) ______________________________
3) ______________________________
4) ______________________________

5) ______________________________
6) ______________________________

5. Special utility services required

a. Electricity
   1) Special lighting requirements (specify)
      a) ______________________________
      b) ______________________________
      c) ______________________________
      d) ______________________________
   2) Electrical needs for other equipment (specify)
      a) ______________________________
      b) ______________________________
      c) ______________________________
      d) ______________________________

b.	Compressed air	Yes	No
c.	Gas	Yes	No
d.	Water		
	1) Drinking fountains	Yes	No
	2) Sinks	Yes	No
	3) Toilets	Yes	No

   4) Other (specify) ______________
      ____
      ____
      ____
      ____
      ____
      ____
      ____

6. Environmental factors

a. Aesthetic. Factors to be considered in the aesthetic domain are color, light, style of architecture, design and the like. Indicate any special aesthetic considerations important to the planning of the instrumentation laboratory area(s).

____
____
____

b. Aerial. Factors to be considered in this category include air temperature, radiant temperature, relative humidity, and ventilation. Indicate any special considerations important to the planning of the instrumentation laboratory area(s).

____
____
____

c. Visual. A properly controlled and balanced visual environment is important. The visual environment affects such things as accuracy in perception, attention to tasks, and speed of performance. Indicate any special factors

which should be taken into account in planning the visual environment of the instrumentation laboratory area(s).
Provision for darkening area

____

____

d. Sonic. Factors to be considered in this category include such things as acoustical requirements and sound system. Indicate any special considerations important to the planning of the instrumentation laboratory area(s).

____

____

e. Safety. In planning school buildings, safety for students and instructors is of prime concern. Indicate any special safety considerations which have implications for design of the instrumentation laboratory area(s).

____

____

____

7. Vertical instructional surfaces

a. Chalkboard	Yes		No
1) Wall-mounted	P	A	NA
Number of lineal feet	________		
2) Portable	P	A	NA
a) Number of lineal feet	________		
b) Provision for storage	Yes		No
b. Tack board	Yes		No
Number of lineal feet	________		
c. Pegboard	Yes		No
Number of lineal feet	________		

8. Minimum floor areas required in square feet

a. Floor area in square feet for the entire instrumentation laboratory area(s) ________

b. If distinct space divisions are desired according to function, give minimum floor area requirement in square feet for each of the following areas, if included in the desired program.
1) Laboratory space ________
2) Darkroom ________
3) Classroom ________
4) ______________________ ________
5) ______________________ ________

9. Other important factors to be considered in the planning of the instrumentation laboratory area(s).

____

____

____

____

FORM M-1

DESCRIPTION OF SCIENCE LABORATORY AREA(S) TO BE USED PRINCIPALLY FOR ACTION LEARNING (BASIC PHYSICS)

1 major emphasis
2 some emphasis
3 slight emphasis
N no emphasis

1. The basic physics laboratory area(s) should be planned:

a.	As independent unit(s)	Yes	No
b.	In combination with ________ laboratory area(s) (specify)	Yes	No
c.	In combination with lecture/demonstration area(s)	Yes	No
d.	In combination with seminar area(s)	Yes	No
e.	As an area within a single multi-use area	Yes	No

2. Student capacity required for scheduled activities (see Form E) ________

3. Spatial relationships. Indicate the extent to which spaces should be accessible to each other. The basic physics laboratory area(s) to:

a. Instructional material center		1	2	3	N
b. Building entrance		1	2	3	N
c. Delivery area		1	2	3	N
d. Other building areas					
1)	________	1	2	3	N
2)	________	1	2	3	N
3)	________	1	2	3	N
e. Other instructional areas					
1)	________	1	2	3	N
2)	________	1	2	3	N
3)	________	1	2	3	N

4. Equipment and furniture

a. Force tables (statics) Yes No
Specify type and number required
________ ________

b. Acceleration apparatus (linear and rotary) Yes No
Specify type(s) and number required
________ ________
________ ________
________ ________

c. Thermometry apparatus Yes No
Specify type(s) and number required
________ ________
________ ________
________ ________

M-

d. Linear expansion apparatus — Yes No
Specify type and number required
________________________________ ________

e. Specific heat apparatus — Yes No
Specify type and number required
________________________________ ________

f. Heat transfer apparatus — Yes No
Specify type(s) and number required
________________________________ ________
________________________________ ________
________________________________ ________

g. Geometric optics apparatus — Yes No
Specify type(s) and number required
________________________________ ________
________________________________ ________
________________________________ ________

h. Physical optics apparatus — Yes No
Specify type(s) and number required
________________________________ ________
________________________________ ________
________________________________ ________

i. Gas-ionization tubes (cathode ray, crookes, Geissler, etc.) — Yes No
Specify type(s) and number required
________________________________ ________
________________________________ ________
________________________________ ________

j. Radioactivity apparatus — Yes No
Specify type(s) and number required
________________________________ ________
________________________________ ________
________________________________ ________

k. Work benches — Yes No
Specify type(s) and lineal feet required
________________________________ ________

l. Storage cabinets — Yes No
Specify type(s) and number required
________________________________ ________
________________________________ ________

m. Student seating
1) Stools — P A NA
Specify type(s) and number required
________________________________ ________
____

2) Other (describe) — P A NA
____
____

n. Built in lockers for storage of students' coats, etc. — Yes No

o. Other equipment required for basic physics laboratory (ex. balances, high voltage power supplies, weights, potentiometers, ammeters, voltmeters, etc.)
1) ________________________________

2) ______________________________
3) ______________________________
4) ______________________________
5) ______________________________
6) ______________________________

5. Special utility services required

a. Electricity
  1) Special lighting requirements (specify)
    a) ___________________________
    b) ___________________________
    c) ___________________________
    d) ___________________________
  2) Electrical needs for other equipment (specify)
    a) Main control panel with rectifier
    b) ___________________________
    c) ___________________________
    d) ___________________________

b. Compressed air Yes No
c. Gas Yes No
d. Water
  1) Drinking fountains Yes No
  2) Sinks Yes No
  3) Toilets Yes No
  4) Other (specify) ______________
  ____
  ____
  ____
  ____
  ____
  ____
  ____

6. Environmental factors

a. Aesthetic. Factors to be considered in the aesthetic domain are color, light, style of architecture, design and the like. Indicate any special aesthetic considerations important to the planning of the basic physics laboratory area(s).

____
____
____

b. Aerial. Factors to be considered in this category include air temperature, radiant temperature, relative humidity, and ventilation. Indicate any special consideration important to the planning of the basic physics laboratory area(s).

____
____
____

c. Visual. A properly controlled and balanced visual environment is important. The visual environment affects such things as accuracy in perception, attention to tasks, and speed of performance. Indicate any special factors which should be taken into account in planning the visual environment of the basic physics laboratory area(s).
Provision for darkening area

d. Sonic. Factors to be considered in this category include such things as acoustical requirements and sound system. Indicate any special considerations important to the planning of the basic physics laboratory area(s).

e. Safety. In planning school buildings, safety for students and instructors is of prime concern. Indicate any special safety considerations which have implications for design of the basic physics laboratory area(s).

7. Vertical instructional surfaces

a. Chalkboard	Yes		No
1) Wall-mounted	P	A	NA
Number of lineal feet			
2) Portable	P	A	NA
a) Number of lineal feet			
b) Provision for storage	Yes		No
b. Tack board	Yes		No
Number of lineal feet			
c. Pegboard	Yes		No
Number of lineal feet			

8. Minimum floor areas required in square feet

a. Floor area in square feet for the entire basic physics laboratory area(s)

b. If distinct space divisions are desired according to function, give minimum floor area requirement in square feet for each of the following areas, if included in the desired program.
1) Laboratory space
2)
3) Classroom
4)
5)

9. Other important factors to be considered in the planning of the basic physics laboratory area(s).

FORM M-2

DESCRIPTION OF SCIENCE LABORATORY AREA(S) TO BE USED PRINCIPALLY FOR ACTION LEARNING (BASIC CHEMISTRY)

1 major emphasis
2 some emphasis
3 slight emphasis
N no emphasis

1. The basic chemistry laboratory area(s) should be planned:

a. As independent unit(s)	Yes	No
b. In combination with ____________ laboratory area(s) (specify)	Yes	No
c. In combination with lecture/demonstration area(s)	Yes	No
d. In combination with seminar area(s)	Yes	No
e. As an area within a single multi-use area	Yes	No

2. Student capacity required for scheduled activities (see Form E) ____________

3. Spatial relationships. Indicate the extent to which spaces should be accessible to each other. The basic chemistry laboratory area(s) to:

a. Instructional material center	1	2	3	N
b. Building entrance	1	2	3	N
c. Delivery area	1	2	3	N
d. Other building areas				
1) ____________________	1	2	3	N
2) ____________________	1	2	3	N
3) ____________________	1	2	3	N
e. Other instructional areas				
1) ____________________	1	2	3	N
2) ____________________	1	2	3	N
3) ____________________	1	2	3	N

4. Equipment and furniture

a. Balances (platform and analytical) Yes No
Specify type(s) and number required
____________________ ____________
____________________ ____________

b. Centrifuges Yes No
Specify type and number required
____________________ ____________

c. Drying ovens Yes No
Specify type and number required
____________________ ____________

d. Muffle furnaces Yes No
Specify type(s) and number required
____________________ ____________
____________________ ____________

FORM M-2

e. Water distillation apparatus — Yes No
Specify type and number required
______________________________ ______________

f. Work benches — Yes No
Specify type(s) and lineal feet required
______________________________ ______________
______________________________ ______________

g. Storage cabinets — Yes No
Specify type(s) and number required
______________________________ ______________
______________________________ ______________

h. Student seating
1) Stools — P A NA
Specify type(s) and number required
______________________________ ______________
______________________________ ______________

2) Other (describe) — P A NA
____
____

i. Built-in lockers for storage of students' coats, etc. — Yes No

j. Other equipment required for basic chemistry laboratory (ex. chemical glassware, voltmeters, milliammeters, gas burners, hotplates, refrigerator, etc.)
1) ______________________________
2) ______________________________
3) ______________________________
4) ______________________________
5) ______________________________
6) ______________________________

5. Special utility services required

a. Electricity
1) Special lighting requirements (specify)
a) ______________________________
b) ______________________________
c) ______________________________
d) ______________________________
2) Electrical needs for other equipment (specify)
a) ______________________________
b) ______________________________
c) ______________________________
d) ______________________________

b. Compressed air — Yes No
c. Gas — Yes No
d. Water
1) Drinking fountains — Yes No
2) Sinks — Yes No
3) Toilets — Yes No
4) Other (specify) ______________________________
____

6. Environmental factors

   a. Aesthetic. Factors to be considered in the aesthetic domain are color, light, style of architecture, design and the like. Indicate any special aesthetic considerations important to the planning of the basic chemistry laboratory area(s).

   ____
   ____
   ____

   b. Aerial. Factors to be considered in this category include air temperature, radiant temperature, relative humidity, and ventilation. Indicate any special considerations important to the planning of the basic chemistry laboratory area(s).

   ____
   ____
   ____

   c. Visual. A properly controlled and balanced visual environment is important. The visual environment affects such things as accuracy in perception, attention to tasks, and speed of performance. Indicate any special factors which should be taken into account in planning the visual environment of the basic chemistry laboratory area(s).

   ____
   ____
   ____

   d. Sonic. Factors to be considered in this category include such things as acoustical requirements and sound system. Indicate any special considerations important to the planning of the basic chemistry laboratory area(s).

   ____
   ____
   ____

   e. Safety. In planning school buildings, safety for students and instructors is of prime concern. Indicate any special safety considerations which have implications for design of the basic chemistry laboratory area(s).

   ____
   ____
   ____
   ____

7. Vertical instructional surfaces

a. Chalkboard	Yes		No
1) Wall-mounted	P	A	NA
Number of lineal feet	____	____	____
2) Portable	P	A	NA
a) Number of lineal feet	____	____	____
b) Provision for storage	Yes		No

FORM M-2

b. Tack board Yes No
Number of lineal feet ____
c. Pegboard Yes No
Number of lineal feet ____

8. Minimum floor areas required in square feet

a. Floor area in square feet for the entire basic chemistry laboratory area(s) ____
b. If distinct space divisions are desired according to function, give minimum floor area requirement in square feet for each of the following areas, if included in the desired program.
1) Laboratory space ____
2) ____ ____
3) Classroom ____
4) ____ ____
5) ____ ____

9. Other important factors to be considered in the planning of the basic chemistry laboratory area(s).

FORM M-3

DESCRIPTION OF SCIENCE LABORATORY AREA(S) TO BE USED PRINCIPALLY FOR ACTION LEARNING (BASIC ELECTRICITY)

1 major emphasis
2 some emphasis
3 slight emphasis
N no emphasis

1. The basic electricity laboratory area(s) should be planned:

a.	As independent unit(s)	Yes	No
b.	In combination with ________ laboratory area(s) (specify)	Yes	No
c.	In combination with lecture/demonstration area(s)	Yes	No
d.	In combination with seminar area(s)	Yes	No
e.	As an area within a single multi-use area	Yes	No

2. Student capacity required for scheduled activities (see Form E) ________

3. Spatial relationships. Indicate the extent to which spaces should be accessible to each other. The basic electricity laboratory area(s) to:

a. Instructional material center		1	2	3	N
b. Building entrance		1	2	3	N
c. Delivery area		1	2	3	N
d. Other building areas					
	1) ________	1	2	3	N
	2) ________	1	2	3	N
	3) ________	1	2	3	N
e. Other instructional areas					
	1) ________	1	2	3	N
	2) ________	1	2	3	N
	3) ________	1	2	3	N

4. Equipment and furniture

a.	Motor-generator set Specify type(s) and number required ________ ________	Yes	No
b.	Dynamometer Specify type and number required ________	Yes	No
c.	Servo-mechanism unit Specify type and number required ________	Yes	No
d.	Cathode ray oscillope Specify type(s) and number required	Yes	No

FORM M-3

e. Work benches — Yes No
   Specify type(s) and lineal feet required ____________

f. Storage cabinets — Yes No
   Specify type(s) and number required ____________

g. Student seating
   1) Stools — P A NA
      Specify type(s) and number required ____________
   2) Other (describe) — P A NA
      ____

h. Built in lockers for storage of students' coats, etc. — Yes No

i. Other equipment required for basic electricity laboratory (ex. meters, strobotac, VTVMs, decade boxes, RLC bridges, galvonometers, variacs, etc.)
   1) ____________
   2) ____________
   3) ____________
   4) ____________
   5) ____________
   6) ____________

5. Special utility services required

a. Electricity
   1) Motor driven machines
      a) 110 V AC — Yes No
      b) 220 V AC, single phase — Yes No
      c) 220 V AC, three phase — Yes No
   2) Special lighting requirements (specify)
      a) ____________
      b) ____________
      c) ____________
      d) ____________
   3) Electrical needs for other equipment (specify)
      a) Main control panel with rectifier — Yes No
      b) ____________
      c) ____________
      d) ____________

b. Compressed air — Yes No

c. Water
   1) Drinking fountains — Yes No
   2) Sinks — Yes No

FORM M-3

3) Toilets Yes No
4) Other (specify) ____________________

____

6. Environmental factors

a. Aesthetic. Factors to be considered in the aesthetic domain are color, light, style of architecture, design and the like. Indicate any special aesthetic considerations important to the planning of the basic electricity laboratory area(s).

____

____

____

b. Aerial. Factors to be considered in this category include air temperature, radiant temperature, relative humidity, and ventilation. Indicate any special considerations important to the planning of the basic electricity laboratory area(s).

____

____

____

c. Visual. A properly controlled and balanced visual environment is important. The visual environment affects such things as accuracy in perception, attention to tasks, and speed of performance. Indicate any special factors which should be taken into account in planning the visual environment of the basic electricity laboratory area(s).

____

____

____

d. Sonic. Factors to be considered in this category include such things as acoustical requirements and sound system. Indicate any special considerations important to the planning of the basic electricity laboratory area(s).

____

____

____

e. Safety. In planning school buildings, safety for students and instructors is of prime concern. Indicate any special safety considerations which have implications for design of the basic electricity laboratory area(s).

____

____

____

____

7. Vertical instructional surfaces

a. Chalkboard Yes No

FORM M-3

1) Wall-mounted P A NA
   Number of lineal feet ____________
2) Portable P A NA
   a) Number of lineal feet ____________
   b) Provision for storage Yes No

b. Tack board Yes No
   Number of lineal feet ____________

c. Pegboard Yes No
   Number of lineal feet ____________

8. Minimum floor areas required in square feet

a. Floor area in square feet for the entire basic electricity laboratory area(s) ____________

b. If distinct space divisions are desired according to function, give minimum floor area requirement in square feet for each of the following areas, if included in the desired program.
   1) Laboratory space ____________
   2) ____________________ ____________
   3) Classroom ____________
   4) ____________________ ____________
   5) ____________________ ____________

9. Other important factors to be considered in the planning of the basic electricity laboratory area(s).

PART IV

ANNOTATED BIBLIOGRAPHY

GENERAL FACILITY PLANNING

American Association of School Administrators. *Planning America's School Buildings*. Washington, D.C.: The Association, 1960.

Contributors to this publication were teachers, supervisors, administrators, architects, engineers, school board members, and school plant planning specialists. In addition to background material on school house construction, the book deals with specific topics including school surveys, analysis and computation of space and facility needs, enrollment projections, building designs, site selection, finance, and building maintenance and operation. Many pictures and illustrations are found, along with sample forms and outlines, which can be used in the facility planning process. No special consideration is given to unique problems faced in the planning for vocational and technical education facilities.

Boles, Harold W. *Step by Step to Better School Facilities*. New York: Holt, Rinehart, and Winston, 1965.

A textbook on overall planning procedures for new and improved school facilities. The typical topics (school surveys, building planning, site selection and acquisition, architectural planning, contracting for construction, and the equipping and furnishing of buildings) are covered. The only mention of vocational schools is on page 270 where the author quotes from another source:

> Vocational training should be de-emphasized in the schools since this training often becomes obsolete before it can be used; also, special "trade" and "vocational" schools should be discontinued, unless the vocational curriculum is liberal in approach and broad in character. Such schools are often used as dumping grounds for students who are not wanted elsewhere and often more than custodial care is provided for them. When more is provided, the skills taught are frequently too partial in nature.

Conrad, M. J. Four Steps to New Schools. Columbus, Ohio: Educational Administration and Facilities Division of the Bureau of Educational Research and Service, The Ohio State University.

A book prepared for the inexperienced school planner. The author emphasizes that a school building is an educational tool and should be designed to do the job it is intended to do. The four steps discussed are: 1) district-wide building survey; 2) educational planning; 3) architectural planning and construction; and 4) moving in and settling down. A glossary of important terms used in plant planning is located in the back of the book.

Conrad, M. J.; Wohlers, E. E.; and Griggs, Norman. School Plant Planning: An Annotated Bibliography. Columbus, Ohio: The Administration and Facilities Unit, School of Education, The Ohio State University, 1968.

A compilation of references in the following categories: general references; periodicals, overview of school plant field, district wide building survey, educational planning, the architect and his work, moving in and settling down, and related topics.

Finchum, R. N. Extended Use of School Facilities. Washington, D. C.: U. S. Department of Health, Education, and Welfare, 1967.

This manual is intended to assist officials of school districts who are planning programs for maximum use of school properties and who must develop policies and regulations for efficient management of such programs. Various schedules of facility use are illustrated for nine different school systems.

Green, Alan C. Educational Facilities with New Media. Washington, D. C.: Department of Audiovisual Instruction, National Education Association, 1966.

This work is designed to meet the needs of three distinct groups interested in providing educational facilities. Report A: "A Guide for Policy Makers" is directed to boards, administrators, planning committees, and institutional planners. Report B: "A Guide for the Design of Professions" is designed for architects, planners, and design specialists and planning committees; and Report C: "A Technical Guide" is intended for design-architects, engineers, equipment and furniture suppliers, and media specialists.

National Council on School House Construction. NCSC Guide for Planning Plants. East Lansing, Michigan: The Council, 1964.

A basic reference on school plant planning and construction for use by superintendents, school board members, school plant planners, state department of education personnel, local school system officials, collegiate institutions, architects, lay advisory groups, and graduate students. Major topics covered are: planning and programming educational plants; spaces and equipment for learning; non-instructional systems; space organization and economy and resources. Much attention is given to plant planning through a description of a survey technique used to determine and satisfy school plant needs for a community. Site selection, kinds of instructional spaces, sonic, termal, and visual environments, and best use of natural and plant resources are also treated.

North Carolina. Department of Public Instruction. A Digest of Educational Planning. Raleigh, North Carolina: The Department.

The contents of this book include a description of what educational planning is, when it is done, who does it, and how it is done. The three steps of planning are identified as: 1) identification and analysis of educational and facility needs, 2) adapting and implementing plant improvement programs, and 3) completing and evaluating a process of the educational planning.

North Carolina. Department of Public Instruction. The Division of School Planning. School Design. Raleigh, North Carolina: The Department.

Basic principles of school design is the thrust of this publication. It focuses on the interrelationship of patterns of school activities, organization of activities on the site, design potentials for various sites, and the building design data necessary for communicating the school's needs to the architect.

School Planning Laboratory. Spectrum of Electronic Teaching Aids in Education. Stanford, California: Stanford University, 1965.

This publication seeks to suggest which learning functions can be served electronically to symbolize the nature and progressive complexity of each electronic system, and finally to estimate budgets which will provide for adequate systems in relation to engineering and warranty costs.

Strevell, Wallace H. and Burke, Arvid J. Administration of the School Building Program. New York: McGraw-Hill Book Company, Inc., 1959.

A comprehensive textbook on the administration of the school plant program. The book is organized into three major parts: Part I - "Policy Decisions" deals with school building needs studies and long-range planning; Part 2 - "Program Recommendations" deals with local study of plant needs, evaluation of existing plant, determination of additional plant needs, site selection and development, and the preparation of educational specifications. Part 3 - "Project Administration" is concerned with the financial aspects of a building program and with public relations. There is a brief mention of the objectives of vocational education as contrasted with the objectives of general education on page 12.

The Cost of a Schoolhouse. New York: Educational Facilities Laboratories, 1960.

This book deals with the cost of a schoolhouse and the process of planning and financing it. It provides median costs for various building elements, designates individual responsibilities in process of building, and discusses arrangement of space and environmental factors.

VOCATIONAL-TECHNICAL FACILITY PLANNING

American Vocational Association. Developing Educational Specifications for Vocational and Practical Arts Facilities. Washington, D. C.: The Association.

The purpose of this publication is to reduce the broad principles and processes of school plant planning to those most applicable to vocational and practical arts education. Effective techniques for developing educational specifications are suggested. The committee provides a sequential treatment of program and administrative considerations, desired space and educational program, special site arrangement features, special physical aspects of building, and the financial requirements for the project.

Calder, Clarence R. Modern Media for Vocational-Technical Education. Connecticut: State Department of Education, 1967.

A study of related literature on programmed instruction, instructional films, instructional television, and learning from various instructional media. It analyzes new instructional media approaches used at North Carolina's Fundamental Learning Laboratories System, and the integrated experience approach at Oakland Community College.

Chase, William W.; Browne, Johnny W.; and Russo, Michael. Basic Planning Guide for Vocational and Technical Education Facilities. Washington, D. C.: Department of Health, Education, and Welfare, U. S. Government Printing Office, 1965.

A general guide that describes important steps to be followed in the planning for and construction of vocational and technical education facilities. Important topics covered are: the impact of the Vocational Education Act of 1963; surveys of area educational needs; use of consultant services; basic planning considerations; educational specifications; general planning; and school construction cost and outlay. Sample floor plans and picture illustrations of vocational schools are included.

McKee, Robert L. and Ripley, Katherine J. The Documentation of Steps to Establish a Technical College and the Evaluation of PERT as a Planning Tool for Educators. Bailey's Crossroads, Virginia: Unpublished report, 1966.

An account of the procedures followed in the establishment of a technical college within a period of less than 90 days. The entire planning process and implementation is described along with the PERT technique which was applied. The author concluded the PERT (Program Evaluation and Review Technique) was effective in assisting the planners in reaching their objectives within a short period of time.

Stanford University. Trends in Facility Design-Vocational-Technical Continuing Information Program. Stanford, California: School of Education, 1966.

The pamphlet emphasizes the need for a total flexibility concept in school building. Consideration is given to the use of building components to provide flexibility in space, lighting, air-conditioning, sewage system, and the like.

U. S. Department of Health, Education, and Welfare. New Ideas and Construction for Vocational Education. Washington, D. C.: Unpublished, 1967.

A report on new trends in the construction of vocational education facilities. Among topics covered are occupational clusters, teaching techniques such as micro-teaching and educational television, facilities for handicapped children, educational parks, and unique problems faced by large city school systems. Special consideration is given to maximum utilization of vocational education facilities on an around-the-clock basis.

Valentine, Ivan E. and Conrad, M. J. Progress Report: Vocational-Technical Facilities Project. Columbus, Ohio: The Center for Vocational and Technical Education, The Ohio State University, 1967.

A report which relates the thinking of six outstanding consultants on various topics relating current trends in vocational-technical education and facility planning. Reviews the work of a local consortium consisting of three Center vocational specialists, three school plant planners, three representatives from the State Department of Education, three local school officials, and three practicing architects in defining problems, clarifying issues, suggesting approaches to organizing planning guides, and establishing guidelines for a series of facility planning guides in selected vocational and technical subject areas.

Wohlers, A. E. A Manual for Planning a Secondary School Building (Vocational Education). Columbus, Ohio: The Administration and Facilities Unit, School of Education, The Ohio State University, Pamphlet C-14.

A general facility planning guide for programs of vocational education. Principal topics covered include: 1) number of teaching stations, 2) types of teaching stations, 3) equipment needs, and 4) floor areas required. The planning manual also deals with spatial relationships of teaching facilities and the utilization of auxiliary areas such as libraries,

cafeterias, and administrative suites. Planners using the guide are directed to complete checklists and fill-in blanks with the necessary information pertinent to vocational facility planning.

METALLURGICAL TECHNICIAN FACILITIES PLANNING

U. S. Office of Education, Division of Vocational and Technical Education. Metallurgical Technology, A Suggested 2-Year Post High School Curriculum. Draft, 1965; now in press.

This publication suggests a curriculum, brief description of all courses, and a summary of building and equipment costs. Although it is foundry oriented, it contains a detailed bibliography.

U. S. Office of Education, Technical Education Program Series No. 7. Scientific and Technical Societies Pertinent to the Education of Technicians.

This publication suggests that "scientific and technical societies are the primary organizers and disseminators of scientific knowledge, procedures, techniques, and methods of application in the world of work. Technical educators turn to these societies to keep up to date and to guide students to an appreciation of their services as an essential part of preparation for employment as skilled technicians."

PUBLICATIONS OF
THE CENTER FOR VOCATIONAL AND TECHNICAL EDUCATION

RESEARCH SERIES

no.	name of publication	cost
1	A National Survey of Vocational Education Programs for Students with Special Needs. April 1967. 89+ [14]p. ED011041	$2.00
2	The Demand for and Selected Sources of Teachers in Vocational and Technical Education, State Directory. January 1967. 31+[5] p. ED012331	o
3	Research and Development Priorities in Technical Education. May 1967. 34 p. ED013888	o
4	Review and Synthesis of Research in Agricultural Education. August 1966. 140 p. ED011562	1.50
5	Review and Synthesis of Research in Business and Office Occupations Education. August 1966. 128 p. ED011566	o
6	Review and Synthesis of Research in Distributive Education. August 1966. 212 p. ED011565	o
7	Review and Synthesis of Research in Home Economics Education. August 1966. 104 p. ED011563	o
8	Review and Synthesis of Research in Industrial Arts Education. August 1966. 88 p. ED011564	o
9	Review and Synthesis of Research in Technical Education. August 1966. 69 p. ED011559	1.50
10	Review and Synthesis of Research in Trade and Industrial Education. August 1966. 76 p. ED011560	o
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11	The Emerging Role of State Education Departments with Specific Implications for Divisions of Vocational-Technical Education. 1967. ED016870	4.50
12	A Taxonomy of Office Activities for Business and Office Education. July 1968. 163 p. VT005935 RIE	2.75
13	Enlisted Men Separating from the Military Service as a Potential Source of Teachers for Vocational and Technical Schools. October 1967. 53 p. ED016131	*
14	Boost: Business and Office Education Student Training; Preliminary Report. 1967. 251 p. VT005131 RIE	3.00
18	Research Priorities in Technical Teacher Education: A Planning Model. October 1967. 48 p. ED016815	o
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1	Report of a National Seminar on Agricultural Education, "Program Development and Research," August 9-13, 1965. 176 p. ED011036	*
2	Guidance in Vocational Education. Guidelines for Research and Practice. 1966. 181 p. ED011922	o
3	Guidelines for State Supervisors of Office Occupations Education. 1965. 84 p. VT001266 RIE	o
4	National Vocational-Technical Education Seminar on the Development and Coordination of Research by State Research Coordinating Units. 1966. 72 p. ED011042	o
5	A Report of the Business and Office Education Research Planning Conference. 1966. 116 p. ED013304	o
6	Program Development for Occupational Education. A Report of a National Seminar for Leaders in Home Economics Education, March 28-31, 1966. 118 p. ED011040	o
7	Report of a National Invitational Research Planning Conference on Trade and Industrial Teacher Education, May 23-27, 1966. 1966. 197 p. ED011043	2.00

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9	Health Occupations Education Centers: Report of a National Seminar held July 11-14, 1966. 1967. ED016823	o
10	Guidelines for Cooperative Education and Selected Materials from the National Seminar held August 1-5, 1966. 1967. 255 p. ED011044	o
11	Systems Under Development for Vocational Guidance. 1966. 60 p. ED011039	o
12	Compilation of Technical Education Instructional Materials--Supplement I. April 1967. 203 p. ED012340	3.00
13	Compilation of Technical Education Instructional Materials--Supplement II. April 1967. 242 p. ED011933	3.50
14	Educational Media in Vocational and Technical Education: Report of a National Seminar. 1967. 240 p. ED017730	o
15	Vocational-Technical Education: National Seminar Proceedings. 1968. 283 p. VT005627 RIE	3.25
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	Abstracts of Research and Related Materials in Vocational and Technical Education. Fall 1967. Quarterly.	9.00 per year
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OFF-FARM AGRICULTURAL OCCUPATIONS		
Instructional Material in:		
	Agricultural Chemicals Technology (Course outline and eight modules) ED013894-ED013902	6.75
	Agricultural Machinery--Service Occupations (Course outline and and sixteen modules) ED012761-ED012777	7.50
	Agricultural Supply--Sales and Service Occupations (Course outline and twelve modules) ED015232-ED015241	7.00
	Horticulture--Service Occupations (Course outline and twelve modules) ED013290-ED013302	o
	Occupational Guidance for Off-farm Agriculture. ED011030	.60
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